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Alleima **Rohit Ojha**

Technical Marketing Specialist Alleima

Industry Experience on Supercritical CO2 Systems Corrosion : Nuggets for Material Selection



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Richard Colwell Chief Engineer, Materials Engineering Technology, **Bechtel Energy**

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Large-Scale Hydrogen: **Compression Challenges in Production**



Sadanand Bhavanishankar Consultant & Advisor, MokMik Inc

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Corrosion Resistant Alloys for Oil & Gas Industry



In the oil and gas sector, corrosion resistant alloys are pivotal for extending equipment lifespan and averting environmental risks. Yet, challenges persist with costly implementation, intricate operational environments, and the imperative for ongoing innovation to counter evolving corrosion hazards. **Rohit Ojha,** a seasoned Materials Engineer with extensive global proficiency in New Alloy and Process Development, serving as **Technical Marketing Specialist, Alleima,** offers invaluable expertise and innovative strategies to drive sustainable progress within the industry.

orrosion poses a significant threat to the environment – triggering oil spills, jeopardizing worker and public safety, causing severe damage to engineering units and shutdown of oil production and refining operations. The ramifications of corrosion can cause significant impacts like economic losses due to maintenance, repair costs and production interruptions.

Corrosion resistant alloys (CRAs) play a critical role as facilitators of advancements in the oil and gas industry, which is divided into two segments: Upstream (exploration and production of oil and gas), and Downstream (refining of oil and gas into finished products such as gasoline, diesel, natural gas etc.) The material selection for each segment depends on their specific operating conditions, which may encompass a range of alloys to address corrosion challenges, including carbon steels, martensitic steels, ferritic steels, brasses, cupronickel grades, austenitic stainless steels (such as 316L, Sanicro[®] 28), duplex family (SAF[™] 2205, SAF[™] 2507, SAF[™] 3207 HD), nickel alloys (such as Sanicro[®] 41 (Alloy 825), Sanicro[®] 625, Sanicro[®] 925 and Sanicro[®] 276) and titanium.

Upstream Oil & Gas

Extreme drilling in well depths of about 3,500 meters has increased the environmental challenges for materials. Operating in such depths demands high-strength materials which can withstand high temperatures, pressure, and the content of Hydrogen sulphide (H2S). With bottom hole pressures surpassing 1000 bar and temperatures exceeding 150°C, the corrosive nature of 'sour' wells, characterized by high levels of hydrogen sulphide, carbon dioxide, chlorides, and free sulphur, presents a formidable challenge. As a matter of fact, H2S, even in low concentrations, poses corrosive threats. Wide variations in operational temperature and pressure range add another challenge to the scenario. To combat these corrosion challenges, it is imperative to use duplex and high-alloy material grades due to their resistance to localized pitting corrosion and stress corrosion cracking (SCC).

For Alleima, our extensive experience in producing seamless tubes for various applications enables us to support our customers in tackling corrosion challenges.

- Umbilical tubes: They connect platforms to subsea systems and are used to inject chemicals into the wells and control the wellhead. SAF 2507 (UNS S32750), a super-duplex stainless steel that combines high corrosion resistance and high mechanical strength, is used in this application. With excellent resistance to seawater and marine environments, it is particularly well-suited for applications exposed to high stress in aggressive chloride-rich environments. It exhibits superior resistance to sour environments compared to SAF 2205.
- Downhole casing and production tubing: Also known as Oil Country Tubular Goods (OCTG), they are used to ensure well integrity. Groups 2 (duplex steels), 3 (austenitic steels) and 4 (nickel alloys) within the API 5 CRA standard (ISO 13680) incorporate duplex grades SAF 2205, SAF 2507 and SAF 3207, alongside austenitic grades Sanicro[®] 28 and Sanicro[®] 29, and nickel based alloy, Sanicro[®] 48, are used cope with the corrosive conditions in these applications.
- Downhole control lines and flatpacks (used to operate sub-surface safety valves), Downhole chemical injection lines, Tubing Encapsulated Cables (TEC) (for downhole well gauges and monitoring) use 316L and Sanicro[®] 41 (Alloy 825) for their corrosion-resistant properties.



Downstream Oil & Gas

Refineries face distinctive material challenges compared to upstream environments. Unlike the relatively standard corrosion challenges upstream, the refining industry encounters a wide spectrum of corrosion mechanisms, exacerbated by geopolitical factors compelling the processing of harsher, sour crudes. These necessitate upgrades in the construction of equipment to prevent failures. Furthermore, the current trend of increasing integration of petrochemicals with refineries introduces additional complexities and corrosion challenges. Petrochemicals like acetic acid, formic acid, and chlorinated hydrocarbons such as ethylene dichloride can also be corrosive. Cooling waters can vary from relatively clean industrial water to seawater, further complicating corrosion challenges, including pitting corrosion, dew point corrosion, under-deposit corrosion, SCC (in the presence of chlorides, sulphides, polythionic acid, and ammonia), erosion, naphthenic acid corrosion, hydrogen-induced cracking, and corrosion in the presence of cyanides, and organic acids. Table 1. provides an overview of the varied corrosive environments in different refining units.

The most severe corrosion problems in the refineries are often found in the hydrotreaters and distillation units. Below, we focus on the case study of the Crude Distillation Unit (CDU) overhead condenser.

CDU Overhead Condensers

CDU overhead condensers often encounter severe corrosion and fouling, leading to increased atmospheric column operating pressure, reduced distillate yield, or tube bundle changes with shorter intervals, typically less than 4-6-year turnarounds. Shutdowns are sometimes necessary to remove salts deposited on internal surfaces. The most severe corrosion problems happen at the top of the distillation tower and overhead condensers, where corrosive condensate forms. When processing difficultto-desalt crudes, high salt content entering the heater can lead to the hydrolysis of calcium and magnesium chloride salts, producing large amounts of HCl. Below the dew point, condensed water droplets can dissolve the HCl gas in the overhead column, turning the liquid acidic and causing severe corrosion in carbon steel. To counteract this, ammonia or amine neutralizers are used, but this can cause SCC in admiralty brass and other copper alloys. The formation of ammonium chloride can also result in under-deposit corrosion.

These conditions necessitate materials resistant to general corrosion, pitting corrosion, under-deposit corrosion, fouling, SCC, and naphthenic acid corrosion. Some of these corrosion mechanisms could cause failures before the regular maintenance shutdown scheduled every 4-6 years, which could cause loss of production. Carbon steel, admiralty brass, Monel, stainless steels (including the duplex family), nickel alloys and titanium have traditionally been used to make CDU overhead condenser tubes.

Alleima presents a groundbreaking solution with Sanicro[®] 35 (UNS: N08935), an alloy combining the best features of super austenitic stainless steel and a nickel alloy. This grade has excellent corrosion resistance for service in CDU overhead condenser tubes, reactor effluent air coolers (REACs), seawater applications, and other highly corrosive environments.

Unit	Temperature (°C)	Corrosion type	Primary cause		
Desalter	50	Localized pitting corrosion	Salts		
Atmospheric distillation	371	Localized pitting corrosion, and flow-induced localized corrosion	Sulphur, Naphthenic acid, Hydrochloric acid (HCI)		
Vacuum distillation	400	Localized pitting corrosion	Sulphur, Naphthenic acid, Hydrochloric acid (HCI)		
Catalytic cracking	600	Intergranular corrosion, SCC, erosion corrosion			
Hydrotreater	670	SCC, Hydrogen embrittlement, pitting	H2S, Ammonium salts, Polythionic acid		
Sour water stripper	245	Localized pitting corrosion, erosion corrosion	H2S, flow velocity, Chloride		

Table 1. Overview of corrosion susceptibility of refinery units

FEATURES



TEMPERATURE

Figure 1. Shows the target area for Sanicro® 35 to bridge the gap between super austenitic stainless steels and nickel alloys

С	Si	Mn	Р	Cr	Ni	Мо	Cu	Other	Fe
< 0.03	0.2	0.64	< 0.03	27	35	6.5	0.16	N=0.3	Balance

Table 2. Nominal chemical composition (weight %) of Sanicro® 35 (UNS N08935)

Sanicro[®] 35 has a stable, fully austenitic microstructure. The grade is characterized by:

- Excellent resistance to pitting and crevice corrosion
- Excellent resistance to stress corrosion cracking (SCC)
- High resistance to general corrosion in acid and caustic environments
- High resistance to erosion-corrosion
- Very high mechanical strength
- Good weldability using nickel alloy consumables

Sanicro[®] 35 boasts an impressive high pitting resistance equivalent number (PREN) of 52, surpassing the performance of both the duplex family and other austenitic grades (see Figure 2). In the rigorous testing process, it exhibited a critical pitting temperature (CPT)



Figure 2. PREN of Sanicro® 35 in comparison with different engineering alloys

ASTM G48 6% Fe Cl. **GROUND SAMPLES (P120)** CCT. °C 60 52.5 52.5 50 45 40 30 20 icro[®] 35 Alloy C-276 625 10 8

Figure 3. CCT of Sanicro® 35, Alloy 625 and C-276

0

of 110°C in a modified ASTM G150 test with 3 M MgCl2 and 89.5°C in an aggressive test with 4.5 M MgCl2 and pH of 5. Furthermore, its critical crevice temperature (CCT), measured in ASTM G48 Method D, was found to be significantly higher than Alloy 625 and at par with C-276 (See Figure 3).

ASTM G 48 D, 0.28 NM, 72H

In summary, Sanicro[®] 35 is a cost-effective alternative that performs at par with, or better than, expensive nickel alloys such as Alloy 625. It has the potential to replace Sanicro[®] 625 (Alloy 625) and Sanicro[®] 276 in several applications, such as CDU overhead condensers and REACs in hydrotreating units within refineries, as well as other heat exchangers in the chemical process industry. Its successful commercial installations in CDU overhead condensers and other heat exchangers across many refineries, in India and globally, attest to its efficacy. ■

Author



Rohit Ojha Technical Marketing Specialist Alleima

14 | February 2024

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President of India Engages with Women Entrepreneurs

New Delhi, India: Under the initiative "The President with the People," President Smt. Droupadi Murmu engaged with prominent women founders and co-founders of leading start-ups and unicorns at Rashtrapati Bhavan. The interaction aimed to foster a deeper connection with citizens and acknowledge their contributions.

Highlighting the transformative role of women entrepreneurs, the President commended their impact on the Indian business landscape. She emphasized the significance of the 'Start-up India' program in leveraging youth potential and fortifying the entrepreneurial ecosystem. India's third-largest start-up ecosystem and over 100 unicorns stand testament to their innovative endeavors.

The President underscored the inspirational journey and achievements of these entrepreneurs, noting their diverse contributions across tech and social sectors. Beyond economic development, they've shattered traditional barriers, empowering future generations and shaping an inclusive economic future based on talent and ambition.

Encouraging collaboration, the President urged entrepreneurs to support aspiring women, fostering empowerment nationwide. She envisioned a ripple effect of success stories, empowering women from all corners of the country. Together, she urged, let us strive for an India where every woman is empowered to pursue her dreams with confidence.

Cabinet Approves Scheme for Promotion of Coal/Lignite Gasification Projects

New Delhi, India: The Cabinet, led by Prime Minister Shri Narendra Modi, sanctioned a scheme for the promotion of Coal/Lignite Gasification Projects, allocating an outlay of ₹ 8,500 crore. The scheme aims to incentivize coal gasification projects across three categories.

Under Category I, Government PSUs will receive a lump-sum grant of \gtrless 1, 350 crore or 15% of capital expenditure (capex) for up to three supported projects, totaling \gtrless 4, 050 crore.

Category II allocates ₹ 3, 850 crore for both private sector and Government PSUs, offering a lump-sum grant of ₹ 1,000 crore or 15% of capex for each project. Additionally, one project will undergo a tariff-based bidding process, formulated in consultation with NITI Aayog.

Category III, with ₹ 600 crore, supports demonstration projects and small-scale gasification plants, offering a lump-sum grant of ₹ 100 crore or 15% of capex for selected entities with a minimum capex of ₹ 100 crore and production of 1500 Nm3/hr Syn gas.

Jai Prakash Dwivedi assumes charge as CMD of WCL



Jai Prakash Dwivedi has assumed the role of Chairman and Managing Director (CMD) at Western Coalfields Limited (WCL). Previously serving as Director (Technical) within the organization, Dwivedi brings over 37 years of experience in opencast and underground coal mining to his new position. Graduating in mining engineering from IIT-BHU Varanasi, he began his career in Coal India Limited (CIL) in 1986. Dwivedi's expertise includes successful labor-force management in the coal mining sector, and he has held various positions within CIL, including SECL, ECL, and NCL. Recognized for his contributions, he was awarded the 'Best Engineer Award' by the Institution of Engineers for his exemplary work in mining. His appointment as CMD extends until his superannuation on January 31, 2026, or until further orders.



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Selection under Categories II and III will undergo competitive bidding, and grants will be disbursed in two equal installments. The Empowered Group of Secretaries chaired by the Secretary Coal holds authority to modify the scheme within the allocated budget.

Cabinet approves MoU between India and USAID for Indian Railways

New Delhi India: The Union Cabinet, chaired by Prime Minister Shri Narendra Modi, was briefed on the signing of a Memorandum of Understanding (MoU) between India and the United States Agency for International Development/India (USAID/India) The MoU aims to support Indian Railways in achieving Mission Net Zero Carbon Emission by 2030.

The MoU serves as a platform for collaboration, facilitating the exchange of knowledge and developments in the railway sector. It focuses on utility modernization, advanced energy solutions, regional energy integration, private sector engagement, and training in areas like Renewable Energy and energy efficiency.

Key activities include long-term energy planning, development of an Energy Efficiency Policy, clean energy procurement planning, regulatory support, bid design for renewable procurement, and promotion of e-mobility. Both parties may request revisions, with the MoU expected to be effective for five years or until the conclusion of the South Asia Regional Energy Partnership (SAREP). The MoU's impact lies in supporting Indian Railways' net-zero carbon emission goal, reducing reliance on imported fuels, and promoting renewable energy technology, fostering local ecosystem development. Notably, the MoU entails no financial commitment from Indian Railways, with technical assistance provided by USAID under the SAREP initiative.

India Energy Week 2024: Global Energy Cooperation



Goa, India: Prime Minister Narendra Modi has inaugurated the India Energy Week (IEW) 2024 in Panaji, Goa, branding it as a significant global event aimed at fostering cooperation in the energy sector. Building upon the success of the inaugural edition in 2023 and India's favorable investment climate in energy, PM Modi positions IEW 2024 as a platform for international collaboration.

During his inaugural address, PM Modi emphasized India's commitment to global energy cooperation,

Manish Kumar assumes additional charge of NCL's CMD post



Manish Kumar, currently serving as Director (Personnel) of Northern Coalfields Limited (NCL), has taken on the additional responsibility of Chairman-cum-Managing Director (CMD) of NCL. Having joined NCL as Director (Personnel) in September 2022, Kumar brings over 29 years of experience in the coal sector to his new role. Prior to his tenure at NCL, he served in Central Coalfields Limited (CCL) and Coal India Headquarters, Kolkata. Kumar is recognized for his adept managerial skills, commitment to human resource management, and decisive decision-making abilities. Under his leadership, NCL is poised to achieve new milestones in various areas, including human resource management and industrial relations. With this appointment, Kumar reaffirmed his dedication to the nation's energy security and called upon the NCL team to sustain their outstanding performance.

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stating that IEW represents not just India's interests but also embodies the spirit of "India with the world and India for the world."

The event boasts a diverse lineup of attendees, including energy ministers and envoys from 15 nations, such as Nigeria, Egypt, Qatar, and the Netherlands. Additionally, representatives from multilateral organizations, including OPEC Secretary General Haitham al Ghais and Arzybek Kozhoshev from the Eurasian Economic Commission, are participating, underscoring the event's global significance.

IEW 2024 serves as a platform for dialogue, collaboration, and knowledge exchange among global stakeholders in the energy sector. With its ambitious agenda and diverse participation, the event aims to drive innovation, investment, and sustainable development in the global energy landscape.

Government Unveils Bold Budget: Highlights Infrastructure and Green Growth



New Delhi, India: In a bid to accelerate economic growth and promote sustainable development, Union Finance Minister Nirmala Sitharaman presented the Interim Budget for 2024-25, with a strong emphasis on infrastructure, research, green energy, e-vehicles, bio-manufacturing, and bio-foundry. Highlighting the government's commitment to fostering resource-efficient growth aligned with the 'Panchamrit goals', she announced a substantial increase in infrastructure investment, with the outlay reaching ₹ 11,11,111 crore, constituting 3.4 percent of GDP.

A significant portion of the budget is allocated to Indian Railways for implementing three major economic corridor programs aimed at enhancing multi-modal connectivity and reducing logistic costs. Moreover, initiatives such as the application of Nano DAP on various crops and the Atmanirbhar Oil Seeds Abhiyan underscore the government's focus on agricultural innovation and self-sufficiency.

The budget also earmarks a corpus of ₹ 100,000 crore for research and innovation, aimed at empowering the youth and fostering technological advancements. In line with India's commitment to achieving 'net-zero by 2070', several measures in green energy, including Viability Gap Funding for offshore wind energy, coal gasification, and phased mandatory blending of biogas in CNG and PNG, were announced.

Furthermore, the government aims to bolster the electric vehicle ecosystem and promote bio-manufacturing through the launch of a new scheme, offering environment-friendly alternatives. The Budget 2024-25 signals the government's proactive approach towards addressing key challenges while fostering inclusive and sustainable growth, setting the stage for a resilient and prosperous future.

Geeta Kapur to hold additional charge of SJVN's CMD post



Geeta Kapur, currently serving as Director (Finance) of SJVN Limited, has been entrusted with the additional responsibility of Chairman & Managing Director (CMD) of the company. Geeta Kapur, who has been with SJVN since October, 2018, previously served as Director (Personnel) and General Manager (Human Resource) within the company. With over three decades of experience, including 24 years at SJVN, she brings a wealth of expertise in human resource management and policy implementation. Notably, she was the first woman officer to join the HR team at Punjab Wireless Systems (PUNWIRE) and holds the distinction of being SJVN's first woman Functional Director. Throughout her tenure, Kapur has been instrumental in shaping HR policies and facilitating wage settlements with unions, further contributing to the company's success.

Smart Rod Systems

(World's Most Effective & Economical 'Non-Chemical' Technology for Prevention of Scales & Biological Fouling in Water Systems)



Smart Rod System enhances the 'Zeta Potential' by applying high pulsating DC voltage, this helps boost surface charge of colloidal particles, causing them to repel one another & from wetted surfaces as well, making them remain in suspension at all times (that would otherwise combine to form scales or biofilms in water systems), thus preventing Scale built-up & Biological fouling.

Applications of Smart Rod Systems include the following:

- (1) For efficient and clean operation of Cooling Towers with greatly reduced Make up water & Blow-down frequencies (by enabling them to operate at relatively higher COC).
- (2) For consistent performance of Chillers by retarding the growth of scale and biofilm built-up in their Evaporators and Condensers.
- (3) For RO Membrane fouling prevention (for continuous & higher through put at all times) with significantly reduced CIPs and with increased membrane life span.
- (4) For enhanced performance of Steam Generators and small to medium sized Boilers.
- (5) For optimized heat transfer of Heat Exchangers in CPI Industries and Surface Condensers in Power plant (by keeping their tubes clean at all times) and preventing expensive downtimes.
- (6) For continuous operation of MEEs to enable ETPs operate at full capacity at all times and reduce the CIP cycles.

Salient Features of Smart Rod Systems:

- (1) Easy to install and incorporate in existing set-ups being very compact in size.
- (2) No moving parts and therefore, practically nil maintenance.
- (3) Has very low operating cost as it consumes only around 0.005 Kw electricity.
- (4) Can be incorporated in Stagnant as well as Flowing water systems as well.
- (5) Can be scaled up for infinity Capacity
- Mildly increases the pH level of water, reducing the corrosion rates of (6) Pipes, Tubes and Fittings.
- (7) Reduces load to the ETP systems due to lower water wastages & thus its operating cost.
- Enables extremely fast payback periods due to reduction in (8) usage of Scale, Biofilm and Algae prevention Chemicals, Chemical storage space, reduced labour inputs & less water wastages.

Typical installation of Smart Rod in Cooling Tower basin



Smart Rod System removes scale & biofouling from the Surface of RO membranes



Smart Rod enhances Chiller performance by ensuring clean tubes all times



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Cabinet to invest in Coal-to-SNG and Coal-to-Ammonium Nitrate projects

New Delhi, India: The Cabinet Committee on Economic Affairs (CCEA) chaired by Prime Minister Shri Narendra Modi has greenlit proposals for equity investments by Coal India Limited (CIL) in two significant projects. Firstly, CIL will invest in the setting up of a Coal-to-SNG (Synthetic Natural Gas) Project at the Eastern Coalfields Limited (ECL) command area in West Bengal, in collaboration with GAIL. Secondly, CIL will participate in establishing a Coal-to-Ammonium Nitrate Project at the Mahanadi Coalfields Limited (MCL) command area in Odisha, partnering with BHEL.

Under these agreements, CIL will infuse equity capital of approximately ₹ 1,997.08 Crore for the Coal-to-SNG Project and around ₹ 1,802.56 Crore for the Coal-to-Ammonium Nitrate Project. These investments will enable CIL to hold a 51% stake in the joint venture companies with GAIL and BHEL, respectively. The total estimated project capital expenditure for the Coal-to-SNG Project is approximately ₹ 13,052.81 Crore, while for the Coal-to-Ammonium Nitrate Project, it stands at around ₹ 11,782.05 Crore.

These initiatives align with CIL's commitment to coal gasification and India's goal of achieving 100 MT coal gasification by 2030. The projects aim to enhance self-reliance and energy independence while fostering economic growth and development in the respective regions. CIL has signed Memorandums of Understanding (MOUs) with GAIL and BHEL to formalize these collaborations, demonstrating its strategic approach towards achieving national energy objectives.

Union Minister Inaugurates NIPER Campus and Healthcare Facilities in Northeast



Assam, India: Union Minister Dr. Mansukh Mandaviya inaugurated the permanent campus of the National Institute of Pharmaceutical Education and Research (NIPER) in Guwahati, Assam, virtually. Additionally, foundation stones were laid for NIPER Hyderabad and NIPER Raebareli. Dr. Mandaviya emphasized NIPERs' role in fostering self-reliance in pharmaceuticals and MedTech, bridging education, research, and industry.

He dedicated five new facilities at the Regional Institute of Paramedical and Nursing Science (RIPANS) in Aizawl, Mizoram, and laid foundation stones for 80 health infrastructure units across seven Northeastern states, furthering the Pradhan Mantri - Ayushman Bharat Health Infrastructure Mission. Notable dignitaries present included Shri Bhagwanth Khuba, Minister of State, Ministry of Chemicals and Fertilizers & New and Renewable Energy, and Dr. Himanta Biswa Sarma, Chief Minister of Assam.

Govt clears appointment of Harish Duhan for CCL's Director (Technical) post



The Government has given clearance for Harish Duhan's appointment as Director (Technical) of Central Coalfields Limited (CCL). The Appointments Committee of the Cabinet (ACC) approved this appointment. As per the Department of Personnel & Training (DoPT) order issued, Duhan will assume office with effect from March 1, until his superannuation on March 31, 2028, or until further notice. Duhan was recommended for the position by the PESB panel during its selection meeting in November, 2023. Currently serving as General Manager at Northern Coalfields Limited (NCL), Duhan brings valuable experience to his new role at CCL.



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NEWS

Dr. Mandaviya highlighted Prime Minister Narendra Modi's commitment to the Northeast and the government's efforts in education, health, and employment. The initiatives underscored the dedication towards enhancing healthcare infrastructure in the region, with significant investments totaling over 725 Cr across various healthcare projects.

Efforts to strengthen India's pharmaceutical sector and reduce dependence on imports were also emphasized, including the establishment of bulk drug parks and the Pharma and MedTech sector's Production Linked Incentive (PLI) scheme. The event marked a significant step towards advancing research, innovation, and healthcare infrastructure in the Northeast.

IREDA and Indian Overseas Bank join forces to scale Renewable Energy

New Delhi, India: The Indian Renewable Energy Development Agency Ltd. (IREDA) has entered into a Memorandum of Understanding (MoU) with Indian Overseas Bank (IOB) to collaborate on co-lending and loan syndication for diverse Renewable Energy projects across India. The MoU encompasses provisions for co-lending and co-origination support, aiming to streamline loan syndication processes and enhance underwriting efficiency. The partnership also includes managing Trust and Retention Account (TRA) for IREDA borrowers and working towards fixed interest rates over a 3–4-year period for IREDA borrowings.



The agreement, signed in January 2024, at IREDA's Business Centre in New Delhi, was attended by key officials, including Chairman & Managing Director of IREDA, Shri Pradip Kumar Das, and MD & CEO of IOB, Shri Ajay Kumar Srivastava. Shri Pradip Kumar Das emphasized the strategic significance of the partnership, highlighting its role in accelerating the growth of renewable energy in line with India's commitment to achieving a 500 GW Non-Fossil-based electricity generation capacity by 2030, as announced at COP26. This collaboration adds to IREDA's successful partnerships with other leading financial institutions, reinforcing their collective support for large-scale renewable energy projects across the nation.

BCCL CMD Samiran Dutta assumes additional charge as CMD of ECL



Samiran Dutta, who is presently serving as Chairman & Managing Director (CMD) of Bharat Coking Coal Limited (BCCL), has assumed additional charge as CMD of Eastern Coalfields Limited (ECL). BCCL and ECL, both are PSUs under the Ministry of Coal. "After the approval of the Appointments Committee of the Central Cabinet (ACC), in the light of the orders of the Ministry of Coal, Government of India and Coal India Limited, Samiran Dutta assumed additional charge of the post on December 28, 2023.

Dutta is an associate member of the Institute of Chartered Accountants of India. He joined Coal Industry in August, 1988 in BCCL, Dhanbad and then was transferred to Coal India Limited, Kolkata, in April, 1990 and where he served in different capacities. He was

promoted to the post of General Manager (Finance) in 2018.

In addition, he was also given the responsibility of the additional charge of Director (Finance) in ECL, Sanctoria. He was also entrusted with the additional charge of Director (Finance) Coal India Limited considering his vast experience in coal industry, Dutta had been bestowed with the charge of CMD of BCC



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HPCL's Budaun CBG Plant to Transform Biomass into Green Energy



Uttar Pradesh, India: In a significant stride towards sustainable energy practices, Union Minister Hardeep Singh Puri and Uttar Pradesh Chief Minister Yogi Hindustan Petroleum Adityanath inaugurated Corporation Limited's (HPCL) groundbreaking Biomass-based Compressed Biogas (CBG) Plant in Budaun. Valued at approximately ₹ 133 crore, the plant boasts a processing capacity of 100 metric tons per day (MTPD) of rice straw, generating 14 MTPD of CBG alongside 65 MTPD of solid manure.

Aligned with the National Biofuel Policy 2018, the CBG Plant contributes to India's target of reducing import dependency by 10%. Minister Puri emphasized the plant's potential to curtail stubble burning on 17,500-20,000 acres, resulting in an annual reduction of 55,000 tons of CO2 emissions. The project is expected to provide direct employment for around 100 people and create indirect employment opportunities for approximately 1000 individuals.

Beyond its economic impact, the CBG Plant signifies a transformative step towards sustainable energy solutions, supporting India's commitment to a future grounded in energy efficiency, accessibility, and environmental responsibility. With the inauguration marking a monumental milestone, the Budaun CBG Plant aligns seamlessly with the Prime Minister's vision for a greener and more sustainable energy landscape in the country.

Dr SP Mohanty assumes charge as full-time MD of HURL



Dr. Siba Prasad Mohanty has joined Hindustan Urvarak & Rasayan Limited (HURL) as its full time Managing Director (MD). Prior to this, he was serving as Chairman & Managing Director (CMD) of Brahmaputra Valley Fertilizer Corporation Limited (BVFCL) and was holding the additional charge of HURL's MD post.

Dr Siba Prasad Mohanty, the Chairman and Managing Director of Brahmaputra Valley Corporation Limited (BVFCL), resigned from his position and assumed the role of Managing Director at Hindustan Urvarak & Rasayan Limited (HURL). Dr Mohanty was serving as CMD of BVFCL since October, 2021. Prior to joining BVFCL, he was serving as CMD of HIL (India) Limited.He comes with more than 27 years of rich and diverse experience primarily

in the Marketing of Agri Inputs. He has also worked in Rashtriya Chemical & Fertilizers Ltd (RCF), Mumbai, in different capacities from 1989 to 2015. Mohanty is a recipient of the "Marketing Man of the Year" award in 1995 and the "Best Employee" Award in 2012 at RCF. Under the Chairmanship of Dr Mohanty, Hindustan Insecticides Limited was awarded several prestigious awards by renowned institutions like Bureaucracy Today (CSR Excellence Award), Times Ascent (Innovative HR practices), The Federation of Indian Chambers of Commerce and Industry (FICCI) etc.



NEWS

Power Minister initiates Green Hydrogen Trials for Transport Decarbonization



New Delhi, India: Union Power and New & Renewable Energy Minister R. K. Singh led a meeting with industry stakeholders to explore the integration of green hydrogen in the transport sector in January 2024. Emphasizing the government's commitment to energy transition and reduction of emissions intensity, Minister Singh highlighted the pivotal role of the transport sector in achieving India's Nationally Determined Contributions (NDC) targets. The discussions focused on pilot projects falling under the National Green Hydrogen Mission, with officials from relevant ministries and representatives from the transport sector in attendance.

Minister Singh called for trials to identify the potential of green hydrogen in the transport sector, aiming to formulate a national roadmap for sectoral decarbonization. He advocated comprehensive comparisons between hydrogen-powered and batteryelectric vehicles, particularly in heavy-duty applications like trucks and buses. The Minister stressed the need for indigenous technology development and assured the industry that costs of green hydrogen, fuel cells, and storage will naturally decrease with scaling up and indigenous manufacturing. The meeting concluded with a shared commitment to advancing hydrogenpowered vehicles and achieving sustainable solutions in the transport sector, aligning with India's NDC targets. If needed, the government expressed readiness to allocate additional funds beyond the earmarked ₹ 496 crores under the National Green Hydrogen Mission for the transport sector.

World Courier Expands Presence in Cold Chain Capabilities

New York, USA: World Courier, a leading global specialty logistics provider under Cencora (formerly AmerisourceBergen), has announced plans to establish transport stations in three new markets across the United States. With stations set to open in Denver, Indianapolis, and San Diego, the expansion aims to enhance World Courier's capacity to store, handle, and transport specialized pharmaceutical products, particularly those requiring cryogenic storage.

The Indianapolis facility will feature liquid nitrogen (LN2) tanks and charging capabilities, augmenting World Courier's global network of charging centers and stations. Matt Virgilio, Regional Vice President of North America for World Courier, emphasized the importance of adapting to the growing complexity of pharmaceutical products in clinical development. He highlighted the company's commitment to meeting evolving demands and ensuring the safe transport of products, from commercially approved cell and gene therapies to vaccines in clinical trials.

Furthermore, World Courier recently unveiled a Container Freight Station at its New Hyde Park facility in New York, further bolstering its logistical infrastructure to better serve clients in the pharmaceutical industry.

BASF and Envision Energy Collaborate on E-Methanol production

Tamil Nadu, India: BASF's Process Catalysts business and Envision Energy, a leading green technology company in China, have announced a collaboration to enhance the efficiency of producing e-methanol (methanol produced with renewable energy) from green hydrogen and carbon dioxide. This partnership aims to integrate BASF's Synspire catalyst technology with Envision's energy management system to develop an advanced, dynamic process design. The viability of this design will be demonstrated at Envision's Chifeng site in Inner Mongolia, China, next year. Detlef Ruff, Senior Vice President of Process Catalysts at BASF, expressed confidence in unlocking the full potential of green hydrogen and CO2 conversion to e-methanol through this collaboration. E-methanol offers advantages such as compatibility with existing infrastructure and inherent stability, allowing for room temperature storage indefinitely. Envision Energy

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Envision Energy's green hydrogen project in Inner Mongolia, approved in August 2023, plans to establish green hydrogen, ammonia, and methanol production across three phases, with full operation expected by 2028. Additionally, Envision aims to establish a 2-GW electrolyzer manufacturing plant in the region and has secured contracts to supply wind turbines to various projects, including NEOM's 2.2-GW green hydrogen production facility.

Epsilon Advanced Materials acquires LFP Cathode Technology Center in Germany

Mumbai, India: Mumbai-based battery materials manufacturer, Epsilon Advanced Materials (EAM), has finalized the acquisition of Johnson Mathery's lithiumion phosphate (LFP) cathode active material technology center located in Moosburg, Germany. This move signifies EAM's strategic expansion into the European battery materials market and its commitment to serving a global clientele.

With this acquisition, EAM aims to establish India as the first country in Asia, outside of China, capable of producing LFP cathode materials. Currently, the majority of cathode materials, including 100% of LFP cathodes, are manufactured in China. By leveraging the expertise of the Moosburg technology center, EAM aims to lead the industry in cathode material manufacturing.

Mr. Vikram Handa, Managing Director of EAM, highlighted the significance of this development, stating that it positions the company to offer comprehensive solutions by providing both cathode and anode materials for lithium-ion batteries.

The acquisition complements EAM's previous investments, including a US\$ 1.1 billion initiative to establish an anode battery materials manufacturing facility in Bellari, Karnataka, India, and plans for facilities in the US and Finland. This strategic integration of cathode expertise enhances EAM's ability to cater to the growing demand for LFP cathodes, known for their longer lifespan, improved efficiency, and environmental sustainability.

The Moosburg facility, employing approximately 25 personnel in R&D and operations, accelerates EAM's technology development and scale-up efforts.

Equipped with advanced capabilities for producing LFP and lithium manganese iron phosphate (LMFP) cathodes, the center utilizes a hydrothermal process for cleaner metal processing, contributing to a more environmentally friendly battery-metals supply chain.

Linde Expands partnership with SAIL

Odisha, India: Linde, listed on NASDAQ as LIN, has announced the expansion of its long-standing agreement with Steel Authority of India Limited (SAIL), a major player in the Indian steel industry. Currently supplying industrial gases to SAIL's Rourkela steel plant in Odisha, Linde will now augment its services by constructing, owning, and operating an additional 1,000 tons per day Air Separation Unit (ASU). This expansion, representing an investment of around US\$60 million, will nearly double Linde's on-site production capacity at Rourkela.

Scheduled to come online by 2026, Linde's new ASU will provide oxygen, nitrogen, and argon to support SAIL's expansion and modernization initiatives at the Rourkela plant. Additionally, the facility will cater to Linde's existing and new local customers in the region, further strengthening its presence in Odisha. Moloy Banerjee, President ASEAN & South Asia at Linde, expressed enthusiasm for supporting SAIL's growth trajectory and enhancing Linde's capability to meet the rising demand for industrial gases in Odisha, a rapidly developing area of India.

India's Coal-Based Power Generation Surges by 10.13%

New Delhi, India: India's coal-based power generation demonstrated robust growth, surging by 10.13% during April-December 2023 compared to the same period in the previous year. The country's overall power generation also witnessed a commendable increase of 6.71% during the same period. Domestic coal-based power generation reached 872 billion units, marking a significant 7.14% rise from the corresponding period last year and ensuring ample coal supply to meet the escalating energy demand.

In a stride towards self-reliance in the coal sector, coal import for blending experienced a substantial decline of 40.66%, reaching 17.08 million metric tons during April-December 2023, compared to 28.78 million metric tons in the corresponding period of the previous year. This reduction underscores India's commitment to bolster



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domestic coal production, minimizing dependence on imported coal.

While India's power generation comprises various sources, coal remains the major contributor, accounting for over 70% of the total power generated. The government continues its efforts to boost coal production, emphasizing increased availability and reduced reliance on imported coal to fortify foreign reserves.

ACME and IHI Sign Historic Pact for Green Ammonia supply



Odisha, India: In a groundbreaking development, ACME Group, a leading Indian renewable energy company, and Japanese heavy industry powerhouse IHI Corporation have sealed a monumental offtake term sheet for the supply of green ammonia from Odisha, India, to Japan. The agreement, valued at an impressive US\$5 billion, which marks a significant stride in India's quest to establish itself as a major global player in green hydrogen and green ammonia production.

The focal point of this collaboration is a state-of-theart 1.2 million metric tons per annum (MMTPA) green ammonia plant, strategically located in Gopalpur, Odisha, underscoring ACME's commitment to meeting Japan's escalating demand for sustainable fuels. The agreement, supported by the India-Japan Clean Energy Partnership, extends beyond mere production to encompass comprehensive collaboration across logistics, supply chain optimization, and the cultivation of a robust market for green ammonia applications in Japan, aimed at substantial emissions reduction.

Union Power and New & Renewable Energy Minister R. K. Singh, a key witness to the signing, underscored the strategic significance of this partnership. He expressed confidence in India's emergence as a premier supplier of green hydrogen and green ammonia at highly competitive rates. This landmark deal aligns seamlessly with the shared vision of sustainability and innovation between India and Japan, simultaneously contributing to India's National Green Hydrogen Mission and Japan's Net Zero commitment.

India Secures Lithium Exploration Project in Argentina



India & Argentina: In a historic development, the Ministry of Mines, Government of India, marked a significant milestone with the signing of an agreement between Khanij Bidesh India Limited (KABIL) and Argentina's state-owned enterprise CATAMARCA MINERA Y ENERGÉTICA SOCIEDAD DEL ESTADO (CAMYEN SE). Union Minister Pralhad Joshi hailed the occasion as a new chapter in bilateral ties, emphasizing its role in driving the energy transition and ensuring a resilient supply chain for critical minerals in India.

This groundbreaking agreement marks India's firstever lithium exploration and mining project by a government company. KABIL will initiate exploration and development of five lithium brine blocks in Argentina, covering an area of approximately 15,703 hectares. The project, valued at about 200 crores, grants KABIL Exploration and Exclusivity Rights, allowing for evaluation, prospecting, and exploration. This strategic move not only fortifies India-Argentina ties but also contributes to sustainable development, securing a diversified supply chain for critical minerals crucial to various industries. Argentina, a key player in the global lithium market, holds significant lithium resources, reserves, and production, making it a crucial partner for India's quest to source lithium. ■



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PROJECT UPDATES

Honorable Prime Minister, lays foundation stone of GAIL's 323-km Krishnagiri to Coimbatore natural gas pipeline



Chennai, India: The projects whose foundation stone were laid include the development of 323-km-long natural gas pipeline from Krishnagiri to Coimbatore section of Kochi-Koottanad-Bangalore-Mangalore Gas pipeline II (KKBMPL II) by Gas Authority of India Ltd (GAIL), and laying of POL pipelines in Common Corridor for proposed grass root terminal at Vallur, Chennai. "These projects of the petroleum and natural gas sector will be a step towards fulfilling the industrial, domestic and commercial requirements of the energy in the region. These will also lead to employment generation,"

said an official statement.

Government extends Bharatmala Phase-I deadline to FY28 amid Implementation challenges

New Delhi, India: In response to challenges and increased costs, the Indian government has granted a six-year extension to the deadline for completing the first phase of the Bharatmala Pariyojana highway development project, now scheduled for 2027-28. The Ministry of Road Transport and Highways (MoRTH) reported that only, 42 percent (15,045 km) of the project had been completed as of yet.

While 76 percent (26,418 km) of highway stretches have been awarded, the awarding pace has slowed in the current fiscal year, with only 102 km awarded in the first eight months. The revised cost of the project has risen over 100 percent to nearly ₹ 11 trillion, prompting financial constraints and necessitating Cabinet Committee on Economic Affairs (CCEA) approval. The initial estimate for Phase-I in 2017 was ₹ 5.35 trillion, but the sanctioned cost of awarded projects now reaches ₹ 8.5 trillion. The Public Investment Board (PIB) appraised the revised cost at ₹ 10.95 trillion. Challenges include increased raw material costs, higher land acquisition expenses, and the construction of highspeed corridors.

With discussions already underway about reconsidering Phase-II, the government faces decisions on executing the remaining 40,412 km of the ambitious Bharatmala project.

DCM Shriram Commits ₹ 12,000 Crore Investment in Gujarat for Chemical and Petrochemical Expansion

Bharuch, India: DCM Shriram has entered into a Memorandum of Understanding (MoU) with the Government of Gujarat, committing to invest a proposed ₹ 12,000 crore in the manufacturing of chemical and petrochemical products in Bharuch by 2028. The MoU signing ceremony took place at Gandhinagar during the Vibrant Gujarat Global Summit 2024, with Chief Minister Bhupendrabhai Patel in attendance.

Currently, DCM Shriram operates significant chloralkali facilities in Bharuch, and the new investment aims to enhance existing capacities while introducing new products for portfolio expansion. Specifically, the company plans to increase caustic soda capacity from 5, 08,000 tonnes per annum (tpa) to 8, 13,000 tpa at Jhagadia in Bharuch.

DCM Shriram is a diversified and integrated business entity with a growing presence in the agri-rural value chain and the chloro-vinyl industry. The company's chloro-vinyl business boasts highly integrated operations and features 225 MW captive power generation facilities. This strategic investment aligns with DCM Shriram's commitment to expanding its chemical and petrochemical footprint, contributing to the economic development of the region and supporting the Vibrant Gujarat initiative.

Balaji Amines' acquires mega project status from Maharashtra Government

Mumbai, India: Balaji Amines has announced that its subsidiary, Balaji Specialty Chemicals Ltd, has received the status of a mega project from the Maharashtra government for its proposed ₹. 750-crore specialty chemicals expansion project at Solapur.



PROJECT UPDATES

The mega project status entitles the company to various incentives, subject to compliance of conditions of 'Package Scheme of Incentives, 2019.'

Solapur-based Balaji Amines manufactures is one of the largest manufacturers of aliphatic amines in India, supplying over 30 products and a production capacity of 2, 31,000-mtpa. The company has been allotted 3, 60,000 sq. meters (90 acres) land in MIDC Chincholi, Solapur. The company will use land for expansion projects.

L&T Construction secures significant project of AIIMS Construction in Rewari

Haryana, India: Larsen & Toubro's (L&T) Construction Buildings & Factories (B&F) Business has been awarded a significant order from HITES, a Mini Ratna PSU under the Ministry of Health and Family Welfare. The order, secured by the Health Business Unit of the HRC SBG, involves the construction of a new AIIMS in Rewari, Haryana, on an Engineering, Procurement, and Construction (EPC) basis in Q3 FY'24.

The project encompasses the development of essential facilities, including a 720-bed Teaching Hospital, a 30bed AYUSH Hospital, a Medical College with an annual intake of 100 students, a Nursing College, a 500-seat Auditorium, and Hostel & Residential facilities. The entire project, covering 1.5 million sq. ft., will be executed within stringent timelines.

L&T's scope of work includes civil structure, Finishes & allied MEP services, built-in Furniture, and the supply, installation, testing & commissioning of various medical infrastructure components. This involves Medical Gas Piping, Modular OT, Pneumatic Tube System, Nurse Call System, Central Sterile Supply Department, and external development works, including landscaping. The order reflects L&T Construction's expertise in delivering comprehensive healthcare infrastructure solutions.

HPL breaks ground for phenol/acetone project in Haldia

West Bengal, India: Haldia Petrochemicals Ltd. (HPL) carried out the ground-breaking ceremony for India's largest phenol/acetone plant in West Bengal's Haldia.

The ₹ 3,000-crore project is expected to be completed by the first quarter of 2026.

The ceremony marking the beginning of piling work was attended by senior officials of the company.

HPL will also be setting up India's first on-purpose propylene plant based on Olefin Conversion Technology (OCT) from Lummus Technology, enabling the company to become India's first integrated player in the phenolics value chain.

The plant will have a capacity of 300-ktpa of phenol and 185-ktpa of acetone, and when completed and fully operational will contribute an additional ₹ 5,000-crore to revenues.

Gensol Engineering secures work order for 33 MW solar power project



Ahmedabad, India: Gensol Engineering Secures ₹ 138.72 Crore Contract for 33 MW Solar Project in Chhattisgarh. Gensol Engineering, based in Ahmedabad, has been awarded a contract by Sarda Energy & Minerals (SEML), a steel and ferroalloy producer, for a 33 MW AC solar power project in Chhattisgarh. The contract, valued at over ₹ 138.72 crore, encompasses designing, engineering, procurement, construction (EPC), and commissioning of the solar facility. Gensol Engineering aims to complete the project within a sixmonth timeframe. The solar plant will serve SEML's Kharora plant in the state.

This contract marks Gensol's entry into Chhattisgarh, contributing to the expansion of its renewable energy portfolio in the region. With an overall market capitalization of ₹ 3,200 crore, Gensol Engineering also received board approval for fundraising of ₹ 300 crore.

As part of the Gensol group of companies, Gensol Engineering has successfully installed ground-mounted and rooftop solar power plants with a combined capacity exceeding 600 MW. In addition to its solar ventures, the company has ventured into electric vehicle (EV) manufacturing, establishing a state-of-the-art facility in Pune for the production of electric three-wheelers and four-wheelers. ■

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Industry Experience on Supercritical CO2 Systems Corrosion -Nuggets for Material Selection

As CO transitions through solid, gas, liquid, and supercritical (sCO2) phases, managing its corrosion characteristics at high pressure and temperature in presence of trace impurities becomes crucial, this feature explores the complexities of designing reliable sCO2 handling systems.

arbon dioxide (CO2) is one of the most important greenhouse gases, and one of its sources is combustion of fossil fuels. To lower CO2 emissions, carbon capture storage (CCS) system technologies are gaining importance.

CO2 exists in solid, gas, liquid, dense supercritical phases (Fig. 1). Design of long-term reliable supercritical CO2 (sCO2) handling systems is a significant challenge especially from corrosion viewpoint. The critical point beyond which CO2 exists in the supercritical phase is 31.1°C and 73.9 bar, representing the highest temperature and pressure where CO2 can exist in supercritical, vapor, and liquid phases simultaneously. At high pressure CO2 can exist as a liquid if temperature is below the critical temperature. In the supercritical phase, CO2 is often termed as 'dense phase'. In the dense phase region, CO2 density increases with decreasing temperature.



Figure 1 - Pure CO2 Phase Diagram

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Existing CO2 (high purity) transportation systems are summarized in Table 1.

For projects under construction or planning shown in Table 2, CO2 is from industrial sources. These CO2 streams contain flue gas impurities (SOx, NOx, HCl, CO, O2, Ar, and H2) in addition to H2S, CH4, N2, and H2O, depending on fuel source, combustion method, and CO2 capture technology. Impurities have been shown to promote corrosion in systems that would otherwise be categorized as dry. Unfortunately, removing impurities in sCO2 streams is costly, and may not be an option in future large-scale CCS system.

Carbon steel (CS) sCO2 pipelines may suffer severe corrosion due to condensation of liquid phases promoted by impurities, thus degrading the operational integrity of CO2 pipelines. According to a report by Det Norske Veritas (DNV) (based on data provided by the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the US Department of Transportation), 29 CO2 transmission incidents were reported from 1986 to 2008. Of these incidents, 45% were caused by corrosion, which ranked first among all causes. Unlike corrosion of steels under low CO2 partial pressure conditions, which has been studied extensively, corrosion of steel in dense phase CO2 requires further research.

Researchers have focused on parameters that govern CS corrosion in dense phase CO2, as the effect of impurities effects phase stability. Correlations between corrosion mechanisms and corrosion rates based on corrosion control strategies and pipeline integrity management are required to allow for material selection to be an effective corrosion control strategy.

FEATURES

Project name	Operator	Country	(Mt a ⁻¹)	Length (km)	Diameter (mm)	Pressure (MPa)	Completion time	CO ₂ source
NEJD	Denbury Resources	U.S.A	-	295	508	-	1976	Jackson Dome
Cortz	Kinder Morgan	U.S.A	19.3	808	762	18.6	1984	McElmo Dome
Sheep Mountain BP		U.S.A	6.3/9.2	296/360	508/610	13.2	1983	Sheep Mountain
Bravo	BP	U.S.A	7.3	350	508	16.5	1984	Bravo Dome
Transpetco Bravo	Transpetco	U.S.A	3.3	193	324	-		-
Central Basin	Kinder Morgan	U.S.A	11.5	278	508/660/610/ 508/406	15.1/15.1/15.8/ 16.5/17.2	-	-
Este	Exxon Mobil	U.S.A	4.8	191	305/356	-	-	÷
West Texas	Trinity	U.S.A	1.9	204	203-305	~	-	75 - 15 C
SACROC	=	U.S.A	4.2	354	406	17.5	1972	Gasification
Val Verde	-	U.S.A	2.5	130	-	-	1998	Val Verde Gas Plants
Canyon Reef Carriers	Kinder Morgan	U.S.A	4.6	225	406	-	-	=
Bati Raman	Turkish Petroleum	Turkey	1.1	90	-	17.0	1983	Dodan field
Weyburn	Dakota Gasification Company	U.S.A and Canada	4.6	330	305-356	20.4	2000	Gasification
Snøhvit	StatoilHydro	Norway	0.7	153	203	15	2007	LNG plant

Table 1: Summary of Existing Long-Distance CO2 Pipelines

Country	Project	Operator	Fuel	Scale/MW	Capture technology	CO ₂ purpose	Status
U.S.A	Kemper County	Southern	Coal	582	Pre	EOR	Under construction
	Petra Nova WA Parish	NRG Energy JX Nippon	Coal	240	Post	EOR	Under construction
	HECA	SCS	Petcoke	405	Pre	EOR	Planning
	TCEP	Summit Power	Coal	400	Pre	EOR	Planning
Canada	Bow City	BCPL	Coal	1000	Post	EOR	Planning
Norway	Longyearbyen	Unis CO ₂	Coal	N/A	Post	Saline	Planning
Korea	Korea CCS	KCRC	Coal	500	Oxy	Saline	Planning
European Union	ROAD	E.ON	Coal	250	Post	Depleted oil or gas	Planning
1999 - C. 1999 - 1999	Magnum	Nuon	Various	1200	Pre	Depleted oil or gas	Planning
	Peterhead	Shell and SSE	Gas	385	Post	Depleted gas	Planning
	Captain	Summit Power	Coal	570	Post	Saline	Planning
	White Rose	Capture Power	Coal	426	Oxy	Saline	Planning
	Killingholme	C.GEN	Coal	470	Pre	Saline	Planning
China	Daging	Alstom & Datang	Coal	350	Oxy	EOR	Planning
	Dongguan	Dongguan Taiyangzhou Power Corporation	Coal	800	Pre	EOR	Planning
	Shengli Oil Field	Sinopec	Coal	250	Post	EOR	Planning
	GreenGen	GreenGen	Coal	400	Pre	EOR	Planning
	Lianyungang	Lianyungang Clean Energy	Coal	1200	Pre	Saline or EOR	Planning

Table 2: Summary of CO2 Commercial Projects under Construction / Planning

CORROSION PREDICTION MODELS

Presently there are no models available that predict corrosion rates in sCO2 streams containing impurities. Proper selection of materials for CO2 transmission pipelines, will require laboratory experiments testing at supercritical conditions to investigate the effect of known impurities on corrosion.

MATERIAL SELECTION

Apart from plant start-up and shut down conditions, key considerations for material selection are captured in Figure 2.

Material selection for sCO2 services requires a detailed understanding of impurity concentration and its effect

Mechanical Properties - High/Low Temp. Strength - Fracture Toughness - Ductility - Fatigue Strength	Chemical Properties - Internal Corrosion - External Corrosion	Practical Properties - Availability - Constructability (forming, casting, welding, and heat treating)	Economics - Considering design life expectancy - Reliability - Maintenance - Life cycle cost	
 Hardness / wear Thermal Conductivity Melting Point 		- Ease of installation		

Figure 2 - Key Criteria for Material Selection



on corrosion. While carbon steel is desired, use of corrosion resistant alloys (CRA) may be required. A published report provides cost multipliers (Table 3) for CRAs. Susceptibility of CS to corrosion, and the reported failures in CS CO2 transport bring past materials selection activities into question (CO2 density is greater than air density, and thus, poses an asphyxiation risk in case of accidental leakage).

Dry CO2 does not corrode CS. When CO2 and H2O molecules are present, and temperature/pressure conditions allow condensation of liquid water, CO2 corrosion results due to carbonic acid (H2CO3). Increasing chromium concentration in steels offers no major improvement in resistance until a minimum of 10.5 % Cr is reached (i.e., Type 409 SS). 300 series austenitic stainless steels are highly resistant to CO2

Table 3 - Cost Multipliers for Materials in sCO2 Systems [10]						
Materials	Cost Multiplier					
CS (X70 approximately \$2000-\$2500 per ton of pipe)	1X					
Stainless steel 304L	3 to 5					
Stainless steel 316L	4 to 6					
Nickel 200	19 to 38					
Monel-Incoloy	12 to 20					
Hastelloy	25 to 38					

corrosion in refinery applications.

Based on the industry and academic research revelations, this paper discusses the influence of the following impurities on CS corrosion.

NON-METALLIC MATERIALS FOR SUPERCRITICAL CO2 SERVICE

It is important to note that internally lined pipelines, and piping components using organic polymer liners need special attention due to swelling, blistering, and delamination during depressurization. The potential for blistering due to rapid depressurization exists. If internal pressure is rapidly reduced when a polymer lining is saturated with CO2, voids can occur, and further depressurization cycles will enlarge voids, creating fissures.

The primary considerations for thermoplastic liners in contact with sCO2 is swelling and rapid crack propagation (RCP). Studies have shown that HDPE has low CO2 solubility, and thus, has a much lower risk of absorption and mechanical damage than other polymers. HDPE in sCO2 does not show appreciable changes in molecular weight, indicating minimal product absorption.

FACTORS AFFECTING MATERIAL SELECTION



Figure 3: Schematic showing the events leading to blistering of polymers

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• Effect of H2S : Small amounts of H2S are known to reduce CO2 corrosion rates. Still, the corrosion mechanisms under H2S/sCO2 conditions are not well understood. H2S is known to cause sulfide stress cracking (SSC), and its concentration needs to be assessed during material selection.

• **Effect of O2 :** Iron carbonate (FeCO3) generally forms a passive film on steel surfaces, retarding CO2 corrosion. If oxygen enters the system, iron oxides form instead of carbonates. Thus, oxygen concentration should be kept under 40 ppb (often <10 ppb).

• Effect of H2O, SO2 : Some work has been reported on CO2 corrosion in the presence of SOx impurities. Corrosion rates of CS were reported to increase from 2.3 mm/y in the presence of 1000 ppm H2O to 4.6 mm/y when 100 ppm SO2 was added to the system at 75.8 bar CO2 at 40°C. When 100 ppm SO2 was replaced by 100 ppm NO2 the corrosion rate increased to 11.6 mm/y.

If an aqueous phase is formed, a few competing corrosion mechanisms can exist, depending on the

type of impurities dissolved in the water phase and the type of cross-chemical reactions taking place. Experiments show that aqueous phases containing NO2, SO2, H2S, and O2 impurities at concentrations within recommended limits contain sulfuric and nitric acid.



ponent	Carriers	Central Basin	Mountain	Dome	Contex	NEID	Skipner	Weyburn	Concentration	Limitation
	50 ppm wt.	257 ppm wt.	129 ppm wt.	-	257 ppm wt.	-	Saturated	<20 ppm vol.	500 ppm	Design and operational considerations
	<200 ppm	<20 ppm (spec)	-	-	0.002%	Trace	<150 ppm	9000 ppm	200 ppm	Health and safety considerations
	-	-	-	-	-	-	-	-	100 ppm	Health and safety considerations
	-	-	-	-	-	-	-	-	100 ppm	Health and safety considerations
	-	<10 ppm wt (spec)	-	-	-	-	-	<30 ppm wt.	Aquifer <4 vol.46 (all non cond. gases), EOR >100 ppm	Technical limit; storage issue
	+	+	-	-	-	-	-	1000	2000 ppm	Health and safety considerations
	2-15% C.H.	0.2%	1.7%	-	1-5%	Trace	Total hydrocarbons: 0.5-2.0%	0.7%	Aquifer <4 vol.46, EOR <2 vol.96	As proposed in ENCAP project
	-	-	0.3-0.6%	-	Trace	-	Total hydrocarbons: 0.5-2.0%	2.3%	-	-
	<0.5%	1.3%	0.6-0.9%	0.3%	4%	Trace	Non-condensable gases (N ₂ - H ₂ Ar): 3–5%	<300 ppm	<4 vol.46 (all non-condensable gasses)	As proposed in ENCAP project
	-	-	-	-	-	-	Non-condensable gases (N ₂ , H ₂ Ar): 3-5%	-	<4 vol% (all non-condensable gasses)	As proposed in ENCAP project
	-	-	-	-	-	-	Non-condensable gases (N ₂ H ₂ Ar): 3–5%	-	<4 vol% (all non-condensable gasses)	Further reduction of H ₂ is recommended because of its energy content
	85-98%	98.5%	96.8-97.4%	99.7%	95%	98.7-99.4%	93-96%	96%	>95.5%	Balanced with other compounds in CO,

Table 4: DYNAMIS CO2 Quality Recommendation Compared to Existing CO2 Qualities

However, it has also been reported that noticeable corrosion in dense-phase CO2 occurs in unsaturated conditions when O2, H2S, SO2, NO2, etc., are present due to synergisms between chemical species.

Effect of NOx: NOx is composed of NO and NO2, and NO can be oxidized to NO2 by O2. Both NO and NO2 were found to cause severe corrosion issues in pipeline steels. The presence of NO2 leads to the formation of HNO3 in condensate, forming an extremely strong acid.

3NO2 + H2O 2HNO3 + NO: HNO3 diffusivity is higher than when compared to HCl and H2SO4, making it easier for NOx to induce severe corrosion compared to other contaminants.

Several sCO2 specifications and recommendations for maximum impurity concentrations have been published, the most referred to coming from the DYNAMIS project. The US National Energy Technology Laboratory (NETL) recommended limits for impurities in CO2 streams based on a review of 43 CO2 specifications found in the literature. However, there is no consensus on what the actual maximum water concentration target should be. The main reason for uncertainty is lack of field experience and laboratory data. It has been argued that extensive dehydration down to 50 ppmv should be applied. This limit has been specified for the first United States CO2 pipelines and for the Snøhvit pipeline in Norway. Other specifications are less conservative as suggested in the DYNAMIS project (500 ppmv) and the Kinder Morgan pipeline (650 ppmv). Suggested values are below the water solubility given in pure sCO2. Table 4 shows DYNAMIS project recommendations.

B. H, Morland et al. conclude that it is not possible to arrive at a "universal" CO2 specification allowing multiple impurities to be present simultaneously. The concentration limits of such a specification would be very low, and to relax the limits some impurities would need to be removed.

CONCLUSION

- For sCO2 pipelines and piping at sequestration facilities, CS has been the material of choice. However, it has not been shown to be operationally risk free.
- H2O in sCO2 streams has a heavy influence on the potential for corrosion. Also, it has been shown that small quantities of SO2, O2, H2S and NO2 (35 ppmv each) result in the formation of a separate aqueous phase that contains corrosive sulfuric and nitric acid.
- The strong oxidation agent NO2 (impurity) can drive most of the reactions, and its complete removal allows for higher concentration of other impurities.
- Material design should include an understanding of upset conditions, and if necessary, include corrosion resistant alloys.

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Large-Scale Hydrogen: Compression Challenges in Production



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s a young boy in late 1960s, hydrogen meant buying floating balloons, filled on demand by the street vendor with a cylinder mounted on an old bicycle. It was a wonder how this balloon floated up, up and away with seemingly no push. Little did I imagine then that this metaphorical balloon could potentially navigate our world towards a clean energy trajectory for the future.

For context, clean energy, of which hydrogen is the central pillar, presumes as well as implies a transition from the current energy dependence on fossil and other non-renewable sources to be replaced by clean, renewable sources, thereby reducing greenhouse gas emissions, particularly carbon dioxide and methane. Though not the only one, clean energy is a pivotal change agent, amongst others, in mitigating the damaging effects of climate change caused by global warming.

Large organizations in the oil & gas sector are recalibrating their vision, goals and actions to include this important energy transition as part of their wider ESG strategy. New Energy companies are already charting a course to be frontrunners in the emerging hydrogen ecosystem. Hydrogen can carry, store and deliver energy and has been traditionally used in the refining, steel and ammonia sectors, utilizing steam methane reforming (SMR) processes based on fossil fuels. Hydrogen production and transportation in the process industry in small to medium quantities is not new and many gas producing companies such as Air Products, Air Liquide, Linde, etc. have been in this business for many decades. However, hydrogen as an energy carrier using clean, renewable energy sources for new applications is relatively new and poses significant challenges in production and transportation when deployed on very large giga watt scale applications, especially when the need to compress it arises.

The scope of this discussion is limited to designing compression systems when hydrogen is produced for captive or consumer utilization using electrolysis from renewable sources of energy such as solar, wind etc.

Large Scale Hydrogen Production Alkaline electrolysers have been in operation for many decades and are proven as compared to relatively new technologies such as PEM, AEM or SOEC electrolysers. Currently, alkaline electrolysers



can be manufactured up to the 15-20 MW range and a large green hydrogen project, example 2 GW, will need approximately 100 such electrolysers operating in parallel. Technology for larger electrolysers of any type is still being prototyped and we are many years away from commercial production and operation.

A typical setup for large scale hydrogen production using alkaline electrolysers with energy from renewable sources is shown in Figure 1. Some of the key factors in determining the best system configuration with optimized equipment for efficient operation and compression are discussed below in brief.

- Pressurised vs non-pressurised electrolysers: Usually, alkaline electrolysis occurs at temperatures from 60 to 90°C, at stack pressures slightly above atmospheric pressure, or when pressurized, at up to 30 bar which lends itself well for further green ammonia / methanol production or transport. However, pressurized electrolysers tend to have higher hydrogen crossover, limited low load operation, safety issues and overall higher energy consumption in addition to other technical complexities. In the context of large scale green hydrogen, we can assume that non-pressurised alkaline electrolysers provide the best production efficiencies (kg H₂/per kWH) of energy used and are also commercially viable.
- Gas Mixture Composition: Typical non-pressurized electrolysis produces a mixture of H₂ saturated with water vapour, some O2 and traces of KOH or NaOH (used as the electrolyte) at a near atmospheric pressure of around 1 bar absolute.
- Volumetric Flow and Pressure Ratio: As is known, H2 is the lightest element on the periodic table with a molecular weight of ~1.996. It occupies large volumes at low pressures. It has also has a very high specific heat (Cp of14.3 kJ/kg K) as compared to say, natural gas (Cp of 2.01 kJ/kg). While this makes hydrogen a very good energy

carrier, it also makes compression very challenging as the low MW and high Cp produces relatively low pressure ratios in hydrogen in dynamic flow machines, for the same head rise as compared to natural gas or CO2. Hydrogen will need more compression stages to achieve the desired pressure ratio. Positive Displacement machines such as reciprocating compressors are governed by the construction geometry of cylinder length, piston stroke volume displacement and though limited to lower discharge temperatures, can achieve higher pressure ratios in lesser number of stages as compared to centrifugal compressors. However, reciprocating compressors are limited to lower flows determined by the cylinder diameter, valve flows and operating speed while centrifugal compressors can handle much larger volume flows. We will look at this in more detail later.

- Production Profiles: Typically, large green hydrogen depends on solar or wind or a combination of both as the primary energy source. Both sources are subject to significant variance in energy production on a daily, weekly, monthly and annual basis depending on a number of external factors such as geography, weather and seasons. These variances, when captured in the hourly production profile, significantly affect the lower and upper limits of production, or in other words, system turndown ratio.
- Energy Storage: Energy can be stored in various forms such as electrical energy in batteries, pumped storage, compressed air energy storage (CAES), compressed hydrogen in salt caverns or other repositories, utilizing pipeline line-pack in the case of transportation. Such energy storage can significantly contribute to balancing supply vs demand anomalies for optimized equipment selection and operation. For other applications, methods such as H2 liquefaction, conversion to Ammonia or LOHCs as hydrogen carriers are also available. Large scale energy storage is still under



development and commercial deployment is yet to take place. Further discussion of energy storage is outside the purview of this article and this factor is not taken into consideration for system design.

Compression Train Operational Considerations: As will be seen in the below case study, the production profile, when matched to equipment selection for system turndown, is likely to necessitate that compressors and electric motor drivers be started and stopped frequently and kept on hot standby (pressurized hold), almost on a daily basis. While it is normal for gas-turbine driven centrifugal compression trains in natural gas pipeline service to be on hot standby for a number of days, careful evaluation needs to be carried out whether similar standby philosophies can be implemented for hydrogen service considering potential embrittlement under static conditions, the slippery nature of the gas, seal design and more importantly, electric motor design and other engineering considerations.

The above listed factors are not exhaustive by any means, but provide a starting point while conducting a feasibility study of a large scale green hydrogen facility. A simplistic example in case is as below

- 2 GW Green Hydrogen (approximately 36 TPH of pure Hydrogen)
- 100 alkaline electrolysers, 20 MW each operating at atmospheric pressure, 40°C
- Required pressure after compression 30 bar absolute
- System turndown of 20% (7.2 TPH of H2)
- Electric Motor drivers using electricity from green energy

In this example, the required pressure ratio is 30. For centrifugal compression, this translates to roughly 70-80 stages in 8 or 9 compressor casings in series, assuming a pressure ratio of 1.4 per stage, average MW of ~2.2 including O2, average 8-10 stages per casing. For the sake of simplicity, we can assume that a single train of nine casings can handle the equivalent volumetric flow of 36 TPH H2 at atmospheric pressure and 40°C. A single train of such large capacity possibly exceeds the largest machine size currently available.

However, the turndown capability of a multi-stage centrifugal compressor driven by a variable speed electric motor, either by frequency variation or speed variation using a hydraulic variable speed drive, is typically in the range of 70% due to surge considerations.

This means that the compressor cannot operate below 25.2 TPH of H2 without recycle. Recycling H2 in the compressor loop is high energy loss and self-defeating in nature. Thus, a single train of centrifugal compression will not meet the system turndown of 20% and is not a viable option.

An equivalent single reciprocating compressor train, (if such a machine exists and it does not due to the high volume flow) will typically have a turndown ration of 25% and can operate at 9 TPH without recycle. The number of stages can vary between 4 to 5, assuming a pressure ratio of around 2.2 per stage. Another option is to consider one reciprocating compressor per electrolyser leading to 100 compressors in parallel. Such compressors are available due to the low volumetric flow per compressor. Theoretically, if only electrolyser and one compressor were to be in operation at 100% load, this provides for a very flexible system turndown of down to 0.36 TPH well below the system requirement. However, this is not a practical consideration for many reasons.

In general, as compared to reciprocating compressors, centrifugal compressors are fully oil-free with zero gas contamination, have no wearing aerodynamic parts due to the non-contact gas flow path, less prone to leakages since there are no contact parts such as piston rings and rod packings, no flow pulsations which eliminate the need for primary and secondary pulsation bottles and the consequent resonant harmonics in piping and equipment, lower maintenance costs and finally, are highly reliable and robust avoiding the need to have spare or standby machines. On the other hand, reciprocating compressors have more flexibility in turndown, are largely insensitive to gas composition and can produce higher pressure ratio with less staging and are probably the best fit for small to medium size production facilities.

Though the theoretical power of compression for both machines is similar, centrifugal compressors are more efficient for same set of operating conditions, due to the inherent compression efficiency, lower mechanical losses, and lesser number of machines. As context, it is important to understand that the gas power required for compression depends on the mass flow and not the volumetric flow. It is not uncommon to realize a difference of anywhere between 4 to 8 percentage points in delivered efficiency.

It is clear from the above treatment that neither one large centrifugal train nor many parallel reciprocating compressors is an optimum solution for a large-scale green hydrogen facility with a varying production profile based on wind / solar sources, utilizing non- pressurized alkaline electrolysers and electricity generated from green energy.

At this point, without considering influences of energy storage, gas mixture - primarily water vapour, as well as non-separation of oxygen, the challenge lies in finding the optimum configuration of compressors to meet minimum system turndown, have lowest power consumption, minimize start-stop events, water condensation, control logics and digital twins and equipment reliability as well as availability.

Additionally, the need to handle water condensation and knock-out during intercooling, oxygen separation prior to end use, drying of hydrogen will dictate close analysis and process coordination between the facility operator, technology provider and equipment suppliers.

It is important that feasibility study addresses the key issue of finding the sweet spot for electrolyser operating pressure. It may make sense to operate the electrolyser around 8-12 bar thus reducing compression load downstream, the compromise being the power penalty and technical complications arising from a pressurized electrolyser design.

In this case study, after the above challenges are addressed, a configuration between four to six parallel trains, comprising centrifugal compressors or a combination of centrifugal and reciprocating compressors, is likely to address the system turndown. This helps in keeping compressor sizes at manageable levels while minimizing the number of machines.

While traditional centrifugal and reciprocating compressors for hydrogen service have been around for a while, equipment manufacturers are now offering innovative machine configurations using conventional technology for immediate project needs as well as racing to develop new compressor solutions with high operating speeds, new materials using advanced composites and alloys, additive manufacturing techniques and completely new products such as integrally geared centrifugal compressors designed specifically for hydrogen service. These new solutions are yet to be used for commercial production and proven technology is unlikely to be available for at least the next 4 to 5 years.

Like all major projects, a well-researched detailed analysis in necessary, which not only addresses the technical and operational aspects but also includes CAPEX and OPEX considerations, not only for compression equipment but also for the complete production value chain commencing from energy sources to the delivery of hydrogen. While none exists today, a complete simulation model with plug 'n play parameters, what-if scenarios, risk assessment and resultant analytical configurations for review prior to the FEED stage will significantly help in making entrepreneurial decisions, even for traditional business process-oriented organizations. Sufficient data and a knowledge bank can be built over a period of time which can potentially modularize and standardize system design.

In conclusion, given the vast number of variables and unknowns in the ever-changing domain of energy transition, particularly hydrogen, each large-scale green hydrogen production facility needs careful and independent evaluation to arrive at the most optimum design, especially compression equipment.

At some point in the future, hydrogen balloons will travel larger, higher and longer lasting trajectories. Our future generations can look back and wonder at what our generation accomplished today.

Advancing Specialty Chemicals for Sustainable Electronics Manufacturing: Global Trends and Indian Industry Insights



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The electronics industry is highly reliant on specialty chemicals, particularly in the production of semiconductor wafers, integrated circuits (ICs) and system-on-chips (SoCs). These specialty chemicals play a crucial role in enabling advanced manufacturing processes and ensuring the performance, reliability and longevity of electronic components. As the demand for electronics continues to grow exponentially, the specialty chemical sector faces both challenges and opportunities. This article outlines key considerations for specialty chemical manufacturers to address the demand-supply gaps and capitalize on emerging opportunities, both on a global scale and within the Indian industry context.

The author started his professional career with Bharat Electronics in 1985. He designed numerous electronics boards for indigenous low-flying target detection radar INDRA-1 and closely worked in the manufacturing set-up. His journey continued with Bell-Northern Research (Canada) and Hughes in the space of telecommunication equipment design. During his leadership position in ST-Ericsson, the mobile chip and embedded platform design brought him even closer to the nitty-gritty manufacturing aspects of semiconductor and electronics. As CTO and CVP of Samsung, one of the proud moments has been the mobile production capacity expansion and inauguration of world's largest mobile factory in India. His current initiative, Xtrans Solutions, is in the design and manufacturing of unified kit incorporating AI/ML, IoT, blockchain and security. Commemorating the 50th year of ChemTech World Expo 2024 in Mumbai, the author, through this article,



Unified Kit by XTrans Solutions for Centers-of-Excellence in AI, IoT and Blockchain

explores how to advance specialty chemicals for sustainable electronics manufacturing. The first segment provides key drivers behind specialty chemical industry for electronics and semiconductor production. The second section contextualizes it from India industry perspective. And the third section provides insight as to how incorporation of sustainability factors and innovative ideas mould the expectations of electronics industry from specialty chemical enterprises.

Global Perspective:

Let us first capture ten key aspects that the specialty chemical companies need to keep in mind as they nurture their businesses for growth in electronics and semiconductor arenas:

- Technological Advancements and Miniaturization: The rapid pace of technological advancements in the electronics industry drives the need for specialty chemicals that can support finer patterning, smaller feature sizes, and increased integration on semiconductor wafers and ICs.
- Reliability and Performance Enhancement: Specialty chemicals that enhance the reliability, thermal management, and overall performance of electronic components are in high demand, especially in sectors like automotive, aerospace, and telecommunications.
- Advanced Packaging Techniques: As packaging technologies evolve to accommodate diverse form factors and performance requirements, specialty chemical manufacturers can seize opportunities by developing materials that enable innovative packaging solutions.
- Environmental Sustainability: With growing emphasis on environmental regulations and sustainable practices, there is a rising demand for specialty chemicals that are eco-friendly, minimize waste, and reduce the overall environmental impact of electronics manufacturing.
- SupplyChain Resilience: Electronics manufacturers worldwide are increasingly concerned about supply chain disruptions. Specialty chemical manufacturers need to establish resilient supply chains, ensuring a steady flow of critical materials to meet industry demands.

- Al and Data-Driven Insights: Incorporating artificial intelligence and data analytics into specialty chemical production can optimize processes, predict demand trends, and improve overall operational efficiency.
- R&D and Collaboration: It will augur well for the specialty chemical companies to invest in core R&D as well as areas like AI/GenAI for chemical industries. It is also essential to have collaboration between electronics manufacturers and specialty chemical producers to develop tailored solutions addressing specific manufacturing challenges and requirements.
- Quality Control and Testing: Ensuring the purity, consistency, and quality of specialty chemicals is critical for maintaining the reliability and performance of electronic components.
- Regulatory Compliance: Adhering to international regulations and standards for chemicals used in electronics manufacturing is non-negotiable. Specialty chemical manufacturers should invest in compliance strategies.
- Global Market Expansion: Exploring emerging markets in Asia, Latin America, and Africa presents opportunities for specialty chemical manufacturers to tap into the rising demand for electronics in these regions.

Indian Industry Context:

With the global macro-level imperatives, let me now highlight five key actions. I believe that the specialty chemical industries in India should strive to pursue these threads in order to facilitate the growth of electronics industries.

- Electronics Manufacturing: India's electronics manufacturing sector is rising with government initiatives such as "Make in India." Specialty chemical manufacturers should align their capacities to cater to the increasing demand from domestic electronics manufacturers.
- Semiconductor Fab Development: With plans for semiconductor fabrication facilities in India, the demand for specialty chemicals will escalate. Manufacturers should gear up to support these indigenous semiconductor manufacturing efforts.



Inauguration of World's largest mobile factory by Samsung in Noida in 2018 with augmented capacity.

- Research and Innovation: Collaborations between Indian research institutions, electronics manufacturers, and specialty chemical producers can foster innovation in materials tailored to Indian market needs
- .- Supply Chain Integration: Efficient supply chain management is crucial to meet the demand for specialty chemicals, particularly when the world is searching for "plus one" manufacturing base. In the process, manufacturers should establish partnerships with logistics providers to ensure timely delivery.
- Skill Development: Investing in workforce training and development to enhance chemical engineering expertise ensures a qualified talent pool capable of meeting the specific demands of electronics manufacturing.

As India establishes semiconductor fabs, specialty chemicals like high-purity gases (e.g., nitrogen, hydrogen) and advanced precursors (e.g., silane) will be vital for chip fabrication. With India's push for renewable energy, specialty chemicals for solar cell and energy-efficient LED manufacturing offer opportunities for sustainable growth. Also, VLSI circuitry and electronics are all-pervasive and support numerous business verticals. For example, nanomaterial-based specialty chemicals for precision agriculture technologies align well with India's focus on sustainable farming practices.

Sustainability and Innovation Factored In...:

While specialty chemical manufacturers proactively address demand-supply gaps and capitalize on emerging opportunities, they also need to embrace sustainability. The customers and stakeholders have started valuing, if not demanding, to raise the sustainability quotient higher. Let us illustrate how specific chemicals and agents could help in various stages of the fabrication and manufacturing process. This approach holds global significance while uniquely catering to the evolving landscape of India's electronics manufacturing journey, promoting sustainability and innovation hand in hand. We delineate here how harmful chemicals can be substituted by alternative chemicals which, in turn, improves carbon footprint.

- Nanomaterials for Miniaturization: Specialty chemicals such as advanced photoresists and lithography materials are essential for enabling nanoscale patterning, crucial for miniaturization in semiconductor manufacturing.
- Eco-Ally Cleaning Agents: Eco-ally cleaning solvents and chemicals, like aqueous solutions and supercritical CO₂, are gaining traction to replace traditional, more harmful options. They reduce both volatile organic compound (VOC) emissions and energy consumption during cleaning.
- Low GWP Gases for Etching: Low Global Warming Potential (GWP) gases like fluorinated gases (e.g., NF3) are used for plasma etching and cleaning processes. This minimizes the environmental impact of electronics manufacturing that stem out of usage of CF₄, SF6.
- Chemical Mechanical Planarization (CMP) Slurries: Eco-friendly CMP slurries with reduced abrasive content optimize material removal in semiconductor planarization processes while minimizing waste.

- Thermal Interface Materials (TIMs): Sustainable TIMs, including non-silicone-based thermal greases and phase change materials, enhance thermal management and longevity of electronic components. Graphene-based or nanocarbonenhanced materials enable easier recycling due to reduced chemical complexity.
- Conductive Polymers for Printed Electronics: Specialty conductive polymers are enabling the rise of printed electronics, offering a more sustainable approach to circuit fabrication compared to traditional methods.
- Lead-Free Soldering Materials: Lead-free solder pastes and fluxes promote sustainability by eliminating hazardous lead content while ensuring robust solder joints in PCB assembly.
- Environmental-Friendly Packaging Materials: Epoxy-based encapsulation resins can be replaced with bio-based or biodegradable alternatives. These encapsulation resins and mould compounds enhance device protection and reduce environmental impact in electronic packaging.
- Data-Driven Green Manufacturing: Utilizing Aldriven insights, specialty chemical production can be optimized to reduce waste, improve yield, and minimize resource consumption.
- E-Waste Recycling Chemicals: Specialty chemicals that aid in the recovery and recycling of valuable materials from electronic waste contribute to circular economy principles.

As semiconductor and electronics are empowering a multitude of the business verticals, the need for specialty chemicals that promote sustainability are also growing. Materials and chemicals improvement and substitution are vital steps toward reducing the carbon footprint of specialty chemical supply chains in semiconductor and electronics production. By adopting sustainable alternatives, the industry holistically can move closer to its goals of environmental responsibility and resource efficiency.



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Transforming Energy Infrastructure with Aucotec's Innovative 'One Tool One Data Model'

In an exclusive interview, **Uwe Vogt, Executive Board, AUCOTEC AG**., shares insights into "One Tool One Data Model" Engineering Base that is helping the energy infrastructure industry by aiding the rapid modernization of grids and improving flexibility. Its innovative data model addresses the challenge of creating a common data repository for plant operators' engineering analysis and operations by serving as a comprehensive data platform.



UWE VOGT Executive Board AUCOTEC AG

How does Aucotec's Engineering Base address the challenge of creating a common data pool for plant operators' engineering analysis and operations?

Plant operators typically have extensive existing assets and various tools, along with vast amounts of data stored in diverse formats. Our software serves as the data platform for these operators, facilitating the importation of data sets from various sources into a unified data repository, which forms the foundation for engineering analysis. It's important to note that engineering and operations are distinct aspects. The primary challenge lies in achieving scalability in this process. When discussing data, it's crucial to acknowledge its scattered nature, existing in different formats such as paper, PDF files, and numerous links, often containing valuable, intelligent data. The key is to selectively identify and scale up this data intelligently, making it more accessible and efficient in a scalable manner to expedite processing.

How does this data help at the FEED or the detailed engineering level?

The Front-End Engineering Design (FEED) phase marks the initial stage of engineering, where we provide support for the fundamental concepts and aspects of plant projects.

In case of designing substations for the electrical grid, these preliminary examinations are done on the level of single-line diagrams and the according objects and data. The big assets of primary switchgear are selected and calculated in regards of energy flow and the basic concepts of interlock and automation are defined.

Our approach encompasses the entire scope of the project. Starting from the FEED phase and progressing through the design of functions, every step is consolidated within the same centralized data model. This comprehensive data repository proves invaluable

INTERVIEW

for later cause-and-effect analyses. In the event of any discrepancies or issues, retrieving information becomes a straightforward process, resulting in streamlined project management and significant time savings.

Tell us about Aucotec's Engineering Base and how is this helping the energy infrastructure industry.

Due to the rising demand for energy and the emergence of new energy sources, transmission and distribution companies are under pressure to rapidly modernize their infrastructure. This transformation requires the extension of numerous grids that are not only more extensive but also smarter and more flexible. This challenge is not unique to any particular region; it applies equally to countries like India and Germany.

The current challenge facing these companies is the need to perform a significantly increased amount of work while simultaneously improving efficiency and optimizing their processes compared to the past. This imperative for efficiency becomes crucial as they manage a greater number of assets. Intelligent systems are essential for maintenance and issue analysis, and data plays a pivotal role in supporting these systems. In recent years, power distribution technology has taken precedence as the primary technology for electrical design and automation, with other technologies serving as secondary. Aucotec's "One Tool One Data Model" approach streamlines both the Front-End Engineering Design (FEED) and detailed engineering processes, allowing for more efficient and timely completion.

How do you enable the project owners to optimise integration of Brownfield facilities with the new capacities & optimize plant performance?

Aucotec provides project owners with tools and offers support for certain engineering operations, although we do not directly engage in day-to-day operations. Nonetheless, our role extends to assisting project owners in consolidating data from their existing assets into intelligent systems, which serve as the foundation for engineering activities. Simultaneously, we contribute to optimizing engineering processes in Greenfield projects.

When it comes to expediting the renovation of substations using Engineering Base, we can generate

intelligent data that significantly increases the potential for faster modernization of plants. Based on standard modules this approach marks a notable departure from the past, where each substation had to be individually designed. With our innovative tools and configuration options, we are transforming the client experience in this regard.

Is it a kind of a plugin play module?

Yes, in essence, it operates on a plug-and-play basis. We offer a wide range of functionalities for configuring these modules, allowing for the generation and customization of configurations. This can be finetuned to align with the specific requirements of our customers to a certain extent.

What kind of changes do you anticipate in the market dynamics & what is your strategy at Aucotec's plan to be a global leader?

The market is experiencing intense competition, and consolidation appears to be on the horizon. On one side, you have numerous small software vendors specializing in various engineering disciplines, while on the other, there are major players like us who consolidate these diverse tools into a single integrated platform. Many vendors find themselves having to string together different tools for various disciplines and then attempt to synchronize the data, often involving translations or other complex processes, especially when dealing with underlying systems like PLS.

At Aucotec, we have developed the platform Engineering Base that works as a unified system with a single data model for all relevant disciplines. This sets us apart from other solution providers and places us in a unique position in the market. We are the sole vendor offering this kind of architecture.

The journey of Engineering Base began roughly 20 years ago, and since the launch of the first version of Engineering Base, we have experienced significant growth. We have rapidly adapted to market dynamics, establishing new subsidiaries along the way. Our mission is to showcase this unique architecture and platform that distinguishes us in the industry.

Cutting-Edge Innovation & Sustainable Solutions - DMCC



With over a century of experience, DMCC pioneers the manufacturing of sulphur, ethanol, and boron chemicals. Their diverse product portfolio includes applications in personal care, home care, electroplating, and brake fluids, showcasing a commitment to sustainability and unique features that set them apart in the market. As they expand their offerings and explore new products for the automotive and agrochemical industries, **Bimal Lalitsingh Goculdas**, **MD & CEO**, **DMCC** highlights organizational aspiration, growth and his passion towards research and innovation.

What is the latest technology or product you displaying during the participation in Chemtech World Expo 2024?

Our latest products have application in Personal care & Home care, electroplating and Brake fluids.

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

The marketing challenges anticipated in India and globally, considering the competitive landscape, include:

- Protectionist Policies
- Bureaucratic Hurdles
- Ifrastructure Constraints
- High Tariffs and Price Sensitivity
- Diverse Regulatory Environment

To position offerings in the Indian and global markets, it is essential to emphasize long-term planning, understand and comply with local regulations, and consider the unique needs and sensitivities of the Indian consumer market. Additionally, leveraging opportunities in sectors where India is opening up, such as digital transformation and free trade deals, can be advantageous. Building strong local partnerships, understanding and adapting to the diverse regulatory environment, and investing in the development of local manufacturing and talent can also help in navigating the challenges and positioning offerings effectively in the Indian and global markets.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?

Sustainability- Our Roha factory is a ZLD factory and Dahej factory will be by this year end, most of our products are backward integrated. Our Products finds its way in Diversified application.

Unique Selling Proposition (USP):

· Unique Features: Following aspects of our



product make our products stand out from competitors. like special feature, superior quality, unique technology.

- Customer Benefits: benefits that our product provides to customers is we not only provide product but also guide to the customer that how our product can be value added and help to improve the quality of their products as compared to the alternatives.
- Uniqueness: our major advantage of the products being manufactured are without burning any net fossil fuel or coal

Give a brief stating your future investments and growth plans for the coming years?

A We are looking at some products in different areas. One of them I mentioned was in automobile fluids which we hope to see some commercialization either next quarter or following quarter. One more product which we are looking forward for coming year, which have application in agro chemicals and this product is boron based product. ■



Bimal Lalitsingh Goculdas MD and CEO DMCC Speciality Chemicals Ltd.



Alchem Synthon Pvt. Ltd.: Scales with Innovation



In the dynamic realm of specialty chemicals, Alchem Synthon Pvt. Ltd. shines as a beacon of innovation and reliability. Established in 2007, this company has cultivated a reputation for excellence by focusing on the development and manufacturing of premium specialty chemicals, particularly serving the pharmaceutical and polymer industries. Under the leadership of **Dr. Dhananjay Rane, Founder & Director of Alchem Synthon Pvt. Ltd.** has demonstrated unwavering dedication to innovation, continuous research and development (R&D), and fostering a culture of excellence. He delves into the remarkable journey, highlighting its trajectory of success, projected growth, and diverse range of pioneering products that are shaping the industry landscape.

Forging a Path to Success:

Alchem Synthon's inception stemmed from Dr. Rane's astute vision and entrepreneurial acumen. Recognizing the escalating demand for anti-cancer and anti-HIV drugs, Dr. Rane seized the opportunity to provide highquality Active Pharmaceuticals Intermediates (API) to leading pharmaceutical companies in India. By forging strong partnerships with industry giants such as Cipla, Dr. Reddy, and Sun Pharma, Alchem Synthon positioned itself as a reliable ally capable of delivering superior products at competitive prices.

Moreover, the company's commitment to expansion and advancement is exemplified by its new manufacturing facility project in Addl. Ambernath Indl. Area, Ambernath (E), Dist. Thane, Maharashtra, India. With due diligence completed and civil construction in progress, this endeavor underscores Alchem Synthon's proactive approach to meeting the evolving needs of the industry. Supported financially by the Technology Development Board, Government of India, this project represents a significant milestone in the company's journey towards continued growth and success.

From its modest origins as a small R&D facility, Alchem Synthon has evolved into a powerhouse of innovation,

consistently pushing the boundaries of chemical synthesis. The company's expertise in synthetic organic chemistry, complemented by a dedicated team of professionals, has been pivotal to its success. Embracing a technology-driven approach, Alchem Synthon has pioneered the adoption of cutting-edge techniques, enabling the scalable production of fine and specialty chemicals with exceptional precision and safety.

Embracing Future Growth:

The future outlook for Alchem Synthon is buoyant, propelled by the projected expansion of the global specialty chemicals market. With a compound annual growth rate (CAGR) of 5.1% anticipated from 2023 to 2030, the company is poised to capitalize on emerging opportunities. The escalating demand from pharmaceuticals, food additives, flavors, and fragrances underscores the significance of Alchem Synthon's diverse product portfolio.

Driven by a commitment to innovation and relentless R&D efforts, Alchem Synthon aims to expand its presence in key markets while fortifying collaborations with leading multinational corporations. Strategic alliances with industry titans like Mitsubishi Chemicals and Nouryon exemplify the company's strategic focus on diversification and innovation. By leveraging its core strengths in synthetic chemistry and manufacturing excellence, Alchem Synthon endeavors to solidify its position as a trusted partner in the global specialty chemicals arena.

Pioneering Products:

At the core of Alchem Synthon's success lie its pioneering products, spanning pharmaceutical intermediates to specialty chemicals for the polymer industry. With a steadfast focus on delivering high-value solutions with unparalleled efficacy, the company has earned acclaim for its excellence across diverse applications.



In the pharmaceutical domain, Alchem Synthon specializes in the development and production of cutting-edge anti-HIV, anti-cancer, and central nervous system drugs. Leveraging advanced technology and state-of-the-art manufacturing processes, the company upholds the highest standards of quality and efficacy in its pharmaceutical offerings. Additionally, its expertise in pharmaceutical intermediates serves as a cornerstone for the production of active pharmaceutical ingredients (APIs), further enhancing its value proposition to customers.

Beyond the realm of pharmaceuticals, Alchem Synthon caters to the polymer industry with a comprehensive range of performance and specialty chemicals. Leveraging its expertise in synthetic chemistry and manufacturing prowess, the company delivers solutions that optimize product performance, durability, and sustainability. Collaborative ventures with industry leaders such as Mitsubishi Chemicals and Neuron underscore Alchem Synthon's commitment to innovation and partnership-driven growth.

In an era characterized by rapid technological advancements and evolving market dynamics, Alchem Synthon Pvt. Ltd. emerges as a trailblazer in the specialty chemicals landscape. With an unwavering focus on innovation, quality, and customer satisfaction, the company continues to set new benchmarks for excellence. As it embarks on a trajectory of growth and expansion, guided by a commitment to research-driven innovation and strategic partnerships, Alchem Synthon is poised to redefine the future of specialty chemicals and shape the industry landscape.



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Dr. Dhananjay Rane Founder & Director Alchem Synthon Pvt. Ltd.

Chemical Engineering World



HEAVY METAL & TUBES

Heavy Metal & Tubes (India) Pvt. Ltd.: Forging the Future of Seamless Steel Tubes, Global Reach, and Unwavering Quality

Heavy Metal & Tubes (India) Pvt. Ltd. is a leading name in the realm of seamless carbon, alloy, and stainless steel tube manufacturing. Under the guidance of Sandeep Kumar Mathur, General Manager, Marketing, the company has established itself as a key player in the industry. This exploration delves into the company's rich history, its diverse production capabilities, and its ambitious goals, especially in the boiler markets.

Pioneering Journey

Founded in 1978, Heavy Metal & Tubes holds a significant position as one of the pioneers in cold-drawn tube manufacturing in India for carbon steel and alloy steel. The company's steadfast dedication to quality and reliability became even more apparent in 1991 when it invested in two state-of-the-art manufacturing facilities at Chhatral in Gujarat. These facilities were exclusively dedicated to the production of seamless carbon and alloy steel tubes, as well as stainless steel seamless and welded tubes.

The strategic investments not only equipped the company to meet the surging demand post the liberalization of the Indian economy in 1991 but also secured a substantial share of the growing Indian market. What sets Heavy Metal & Tubes apart is its ability to produce a wide array of tubes and pipes in various grades, thicknesses, sizes, and lengths, all under one brand. According to Mr. Mathur, "No one else does what we are doing in India," proudly tagging the company as a perfect blend of Quality and Integrity.

Technological Advancements

Heavy Metal & Tubes places a strong emphasis on staying at the forefront of technology. The company



continually invests in cutting-edge technology and top-tier talent to ensure the consistent delivery of highquality products that exceed customer expectations. Specializing in seamless carbon and alloy steel tubes/ pipes, as well as stainless steel seamless and welded variants, the manufacturing journey begins with round bars.

The product range is offered in both hot finish and cold finish conditions, showcasing a wide range of



Chemical Engineering World

SPECIAL Cher

sizes concerning outside diameter, wall thickness, and length. This versatility positions Heavy Metal & Tubes as a significant player, not only in the domestic market but also on the global stage.

Milestones and Aspirations

achievements Recent include the successful manufacturing of arbor coil bends made from ASTM A335 P9 grade steel. These bends, with specifications like 101.4 mm OD, 5.74 mm WT, and a bend diameter of 3000mm (with a radius of 1500mm), were produced for a state-owned refinery. Additionally, the company has enhanced its product quality by commissioning a new state-of-the-art controlled atmosphere bright annealing furnace. This investment ensures the supply of higher quality products without the need for acid treatment, guaranteeing improved mechanical properties and surface finishes.

Looking ahead, Heavy Metal & Tubes is set to strengthen its technological capabilities further by introducing cutting-edge machinery for seamless tube production by November 2023. This initiative includes the integration of a state-of-the-art piercer machine and the expansion of its pilger machine fleet to 30 units for the Stainless Steel Division. Accompanying these advancements is the incorporation of a heavyduty draw bench for seamless carbon and alloy steel tubes with heavy wall thickness.

Milestones

Mr. Mathur stresses that Heavy Metal & Tubes were able to supply T-9/91 grade Alloy Steel Tubes & Pipes in recent past. Several orders were executed to domestic & overseas customers/projects, few of them are listed below.

- 1300 M Ton supplied to BHEL for Yadadri power plant.
- 25 M ton supplied tubes to Nayara Energy. Repeat order also received.
- 50 M ton supplied to HE Fabricator in UAE for Emirates Steel, Dubai project.
- 10 M ton supplied to Sugar Mill in India in 2 weeks' time.
- 26 M ton supplied to Petrobras, Brazil through local supplier.



Focus on Key Markets

Heavy Metal & Tubes seamless and welded tubes play a crucial role in various industrial segments, including shell & tube heat exchangers, air-fin coolers, boilers, condensers, and more. These tubes find applications in vital industries such as oil & gas, refineries, chemical & petrochemical, pharmaceutical, power plants, sugar, and fertilizer plants globally.

One noteworthy differentiator is the company's capability to produce tubing up to 34 meters long, a feature that sets it apart in the Indian market. In addition to the aforementioned segments, Heavy Metal & Tubes also supplies tubes for the automobile industry, locomotives, defense sector, hydraulic and pneumatic systems, instrumentation, and various other sectors.

Commitment to Quality

Quality assurance is a cornerstone of Heavy Metal & Tubes' operations. Specialized in the manufacture of heat exchanger & boiler tubing, the company subjects these critical components to a series of stringent quality checks throughout the production process. Heavy Metal & Tubes proudly holds ISO 9001:2015 and PED accreditation, emphasizing its commitment to maintaining the highest quality standards.

The company's quality assurance system covers all





production stages, from raw materials and cold working to heat treatment, packing, and dispatch. All components adhere to the requirements of national and international codes, as well as individual customer's quality and technical specifications. The quality control department operates independently of the manufacturing shop, ensuring an unbiased assessment.

A wide range of testing facilities, including air-underwater, eddy current, flaring, flattening, hardness, hydro, reverse bend, tensile, and ultrasonic tests, are conducted as per code requirements. Laboratory tests with spectrometers, metallurgical investigations, and corrosion assessments further contribute to the robust quality assurance process. The company's production sites are equipped with reliable testing and measuring equipment for destructive and non-destructive testing, such as intergranular corrosion testing, eddy current testing, and ultrasonic testing.

Heavy Metal & Tubes holds approvals from significant inspection agencies like ABS, Bureau Veritas, DNV, EIL, IBR, LRIS, Intertek, PDIL, SGS, and TÜV, showcasing its adherence to high-quality standards. Additionally, the company is approved by numerous major customers and end-users, including PEMEX, QP, SABIC, BHGE, Alfa Laval, BHEL, BPCL, CPCL, FACT, HPCL, IOCL, KFL, L&T, NFL, NPCIL, NTPC, TECHNIP, Reliance, SAIL, and many others.

Valuing Expertise

One standout aspect of Heavy Metal & Tubes is the high standard of technical competence among its staff. Knowledgeable and skilled, with relevant technical degrees where appropriate, the employees are also characterized by loyalty and commitment. Some have been with the company for fifteen to thirty years, highlighting the positive work culture that encourages skill retention and experience.

In an era where companies often struggle to fill technical vacancies, Heavy Metal & Tubes attracts young engineers eager to contribute to the company's success. The management takes a keen interest in helping them shape their careers. The company's commitment to the well-being of its employees is evident in its accreditations for health & safety and the environment, including certifications ISO 14001:2015 and OHSAS 18001:2007 & 45001.

Global Presence and Market Strategy

Product range

Hot and Cold Finished Carbon & Alloy tubes and pipes:

Tube grades produced in carbon steel include: ASTM A-106 Gr. A/B/C, A-179, A-192, A-210 Gr. A1/C, A-334 Gr.1/3/6, A-556 Gr. A2/B2/C2, ST 52,

4130, 4140, 6620, 8630 and their equivalents in ASME, DIN, EN, GOST, JIS, BS, etc.

Alloy steel grades produced include:

ASTM A209 T1, A-213 Gr. T2/T5/T9/T11/T12/T22/ T91, A-335 Gr. P1/P2/P5/P9/P11/P12/P22/P91 and their equivalents in ASME, DIN, EN, GOST, BS, etc... Manufacturing size range:

- OD: 4 mm to 220 mm
- Thickness 0.5 to 25 mm

Stainless steel seamless and welded tubes and pipes:

In stainless steel the range includes:

ASTM A-249/268/269/213/312/554/688

Grades TP304, 304L, 304H, 304LN, 310, 310H, 316, 316L, 316H, 316Ti, 316N, 316LN, 317, 317L, 321,

321H, 347, 347H, 405, 410,

Duplex 31803/32205, Super Duplex 32750/32760 and their equivalents in ASME, DIN, EN, GOST, JIS, etc. Manufacturing size range:

- OD: 4 mm to 220 mm
- Thickness 0.5 to 25 mm

Max up to 34mtrs long tubes can be produced in all grades. Products are also produced to the specific requirements of individual clients.

Approximately 60% of Heavy Metal & Tubes products are sold within India, with the remaining 40% exported worldwide. The company's products reach various corners of the globe, including the Americas (Argentina, Canada, Brazil, Chile, Mexico, USA), Europe (Belgium, France, Germany, Greece, Italy, the Netherlands, Spain, Turkey, United Kingdom), and the Middle East (Bahrain, Kuwait, Oman, Saudi Arabia, Qatar, UAE).

Clients in South Korea, Japan, Singapore, Australia, and several other countries also benefit from the quality and services provided by Heavy Metal & Tubes. The company receives a considerable number of repeat

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orders, underscoring the appreciation clients have for its offerings.

Concerning the tubing market for heat exchangers, Heavy Metal & Tubes focuses its sales efforts on four major regions: India, South Korea in Asia, Italy in Europe, and North America. While these regions are primary, the company recognizes the significance of manufacturers in the former Eastern Block countries of Europe, Russia, and the Gulf nations.

Approximately 60% of HMT's products are sold within India, while the remaining 40% are exported globally. The company's products reach diverse regions, including the Americas, Europe, the Middle East, South Korea, Japan, Singapore, Australia, and more. The appreciation for the quality and services provided by HMT is evident in the large number of repeat orders received regularly.

In the tubing market for heat exchangers, HMT strategically concentrates sales in four major regions: India, South Korea in Asia, Italy in Europe, and North America. The company also serves manufacturers of heat exchanger equipment in the former Eastern Block countries of Europe, Russia, and Gulf nations

Forward-Looking Strategy

Heavy Metal & Tubes acknowledges that expanding its product range is a simple strategy for growth and better service to its customer base. The company is set to enter the fittings and flanges market, defining its entire product range shortly. Mr. Mathur outlines the future strategy as continuing to serve domestic and global markets with the highest quality standards, utilizing fully Indian-origin material right from basic raw materials.

With an eye on the growing demand for tubes and pipes in demanding applications, Heavy Metal & Tubes plans to concentrate increasingly on serving manufacturers of heat exchangers and boilers. The company has expanded its marketing team to aggressively cover this market, ensuring it stands by its customers to secure their future successes.

In conclusion, Heavy Metal & Tubes has built a legacy of excellence, innovation, and commitment to quality. As it forges ahead with its strategic initiatives and

Heavy Metal & Tubes recent achievements

- 20 M ton of CS boiler tubes produced from round bars to finished tubes in 4 days' time for HMEL.
- Executed Alloy Steel tubes order @ 75 M ton for Heat Exchanger for PEMEX Refinery.
- Executed @ 500 M ton of SS tubes order required for 56 nos Heat Exchangers for PEMEX Refinery.
- Executed @ 135 M ton of CS St. & "U" Tubes for 53 nos Heat Exchangers for Qatar Petroleum Project.
- Executed @ 75 M ton of CS Boiler Tubes to OEM in Columbia in 21 days.
- Supplied HP Heater Tubes to BHEL, TOSHIBA & L and T with tubes are hydro tested above @600 kg pressure.

technological advancements, the company is poised to remain a frontrunner in the industry, offering reliable and high-quality solutions for a diverse range of applications. ■

Contact Heavy Metal & Tubes at Email: info@hmtl.in Mobile No. : +91 90165 49266 Webpage: www.hmtl.in



De Dietrich India, Unveils Expansion Stratergies



Manickam Valliapan, MD, De Dietrich Process Systems India Pvt. Ltd., introduces De Dietrich India as a subsidiary of De Dietrich SAS, headquartered in Alsace, France. De Dietrich boasts a global presence with 7 manufacturing sites, 10 engineering and sales offices, 8 assembly and service centers, and 3 tech labs and trial centers. He provides insight into the company's mission, aiming to enhance public health and environmental conservation by delivering comprehensive and innovative solutions. These solutions prioritize operational safety, product quality, and environmental protection, supporting clients in the pharmaceutical, chemical, plant-based chemistry, and waste recycling sectors.

What is the latest technology or product you displaying during the participation in Chemtech World Expo 2024?

We are excited to showcase our latest developments in India.

- SiC Heat Exchanger: Our flagship exhibit for this event is SiC Heat Exchangers. These "Made in India" heat exchangers are at the forefront of our efforts by providing tailor-made solutions for process-specific requirements. The equipment manufactured at our facility is of superior quality with a vast range of heat transfer area requirements. De Dietrich is globally known for its glass-lined and glass equipment and we provide heat exchangers with our own components.
- Bromine Recovery Units: We are proud to announce De Dietrich India as One Point Solution for Bromine Recovery ranging from 1,000 TPA to 25,000 TPA, from Concept to commissioning (Project viability, Basic Engineering, Detail Engineering, Supply of equipment, Installation and Commissioning) with a feed containing minimum bromine content of 150 ppm
- Rotary Evaporator: Our commitment to innovation extends from manufacturing laboratory and pilot scale Rotary Evaporators. Our equipment is fully equipped with the latest automation and Imported QVF glass components from Germany
- Sintered Mesh: Our Sintered Mesh, manufactured with imported components are used in ANFDs and RCVDs are of superior quality. In summary, our participation in Chemtech World Expo 2024 is centered on demonstrating new products and developments, unveiling SiC Heat



exchangers, bromine Recovery and R& D models of Rotary Evaporators in the pharma and chemical manufacturing sector.

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

Anticipating and addressing marketing challenges is crucial in India as well as global.

- Identifying Competitors: In both the Indian and global markets, there are established players with significant market share. Anticipating the strategies and innovations of these competitors is vital.
- **New Entrants:** The industry may see new entrants with innovative technologies. Staying vigilant about emerging companies is essential to stay competitive.
- Product Differentiation: We aim to differentiate our offerings through innovation, quality, cost





effective and customization. This could i n v o l v e highlighting u n i q u e features of our equipment, such as a d v a n c e d materials and

process optimization capabilities.

- Online Visibility: In today's digital Era, having a strong online presence is non-negotiable. De Dietrich group is in makeover of digital marketing strategies, including a user-friendly website, social media presence, and targeted online campaigns, to reach a wider audience globally and in India.
- Content Marketing: Providing valuable content, such as case studies, whitepapers, and webinars, we position us as thought leaders and help build trust among our target audience.

By proactively addressing these challenges and implementing a comprehensive marketing strategy, we aim to position our offerings as the preferred choice in the competitive pharma and chemical equipment manufacturing landscape, both in India and on a global scale.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?

As the Managing Director of a De Dietrich India, let me outline the Unique Selling Proposition (USP) of our flagship product and provide insights into the current and projected demand in the market:

- Safety and Compliance: We prioritize safety by incorporating advanced safety features and ensuring compliance with stringent industry regulations. This not only safeguards the wellbeing of workers but also positions our product as a reliable and compliant solution for our clients.
- Process Optimization: Our equipment incorporates cutting-edge technologies to optimize manufacturing processes, resulting in increased efficiency.
- Modular Design: The modular design of our equipment allows for scalability and flexibility, catering to the diverse needs of our clients. This adaptability ensures that our solutions can be easily integrated into existing production setups or expanded for future growth.

Market Demand:

- *Current Demand:* The current pharma market is growing at approximately 6-8% and we anticipate similar growth in our equipment. Similarly, 8-10% growth is also observed in Agrochemical, petrochemical and specialty chemical. India is an emerging market with latest developments it is estimated to grow further. We cater significantly to pharma and chemical market accordingly we see increase in demand for our product.
- *Projected Demand:* Our market research and industry analysis indicate a strong upward trajectory in demand. Looking ahead with significant increase in demand we see growth in our product portfolio. To meet increasing Indian demands we have a plan Ambition 2026, a De Dietrich group vision, which will be revealed in due course time.

Give a brief stating your future investments and growth plans for the coming years?

Our Road map for 2024 is based 4 major pillars

- Expand & Perform
- Transform and Mordernize
- Diversify and Develop
- Attract and Sustain

investments and plans growth Future are strategically diversified in form of pillars and aligned to meet the evolving needs of the industry. We plan to expand and invest in India this vear to capitalize Indian opportunities, Our people are our most valuable asset. Investments in training programs, talent acquisition, and employee well-being initiatives will be prioritized to ensure a skilled and motivated workforce.

A well-trained and engaged team will contribute to our innovation efforts, enhance customer service, and support the successful implementation of our growth strategies. ■



Manickam Valliappan Managing Director, De Dietrich Process Systems India Pvt. Ltd.



Arvico Rubber Industries: Leading the way in Polymer Products and Sustainable Solutions



Arvico Rubber Industries, with over 55 years of expertise, is a distinguished manufacturer and exporter specializing in top-tier polymer products. Their diverse range includes Rubber Diaphragms, Expansion Joints, Screw Pump Stators, and more. In an exclusive interview, **Darshil Shah, CEO, Arvico Rubber Industries,** discusses their innovative products, marketing strategies, unique selling points, and future growth plans in the competitive rubber industry.

What is the latest technology or product you displaying during the participation in Chemtech World Expo 2024, highlight your Specialisation

Arvico Rubber Industries, a distinguished manufacturer and exporter specializing in top-tier polymer products. With over 55+ years of industry expertise, we take pride in delivering a diverse array of high-quality rubber products to over 12+ countries. Our comprehensive product line includes Rubber Diaphragms, Expansion Joints, Screw Pump Stators, Bearing Bushes, Gaskets, O-rings, Sleeves and Seals, Extruded Rubber Profiles, Molded Rubber Parts, PTFE Components, Hoses, Rubber Sheets, and more.

Displaying Product in CHEMTECH WORLD EXPO 2024: .

- Pumps Diaphragm Impellers
- Muff for Pinch Valves
- Rings / Quad Rings
- Screwed Pump Stators
- Bushes / Gaskets
- Sleeves
- Bellows
- Hoses
- Grommets
- Chevron Packings
- Oil Seals
- Couplings
- Rubber Profiles
- Teflon Washers
- PTFE Components
- Valves Diaphragm
- Control Valves Diaphragm
- Teflon Laminated Diaphragms
- Dosing Pumps Diaphragm

- Metering Pumps Diaphragm
- Membrane Diaphragms Diaphragm
- Actuators Diaphragm
- Solenoid Valves Diaphragm
- Regulators Diaphragm
- Fire Protection Equipments
- Brine Filters

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

At Arvico Rubber Industries we appreciate the everevolving landscape of rubber products. We recognize the challenges outlined in India and globally, and want to assure you that we are constantly innovating and strategizing to stay ahead.

India :

- Competitive Edge Through Specialisation: We are striving to enhance our expertise in specific markets. Our vast product portfolio of over 2500+ custom-engineered products allows us to meet specific industry needs, offering solutions beyond typical offerings.
- Unwavering Quality: We've built our reputation on exceptional quality, and that remains our cornerstone. Stringent quality control measures and adherence to international standards ensure our products perform reliably even in demanding applications.
- Value Beyond the Product: We understand that customers deserve more than just rubber components. We're committed to providing value-







added services like technical support, on-site consultation, and even co-designing solutions with our clients.

- Regional Reach with Local Touch: We are expanding our presence across India, our focus has always been to reach our smallest rubber products to every region of India. And we also ensure that most of our focus is on working with OEMs.
- Digital Transformation: We are adopting digital services, using e-commerce platforms, targeted online advertising and social media engagement to reach wider audiences.

Global:

- Building a Global Brand: We're actively creating a brand identity that resonates internationally. By showcasing our commitment to quality, innovation, and sustainability, we aim to become a recognized leader in the global rubber industry.
- Strategic Partnerships: We're actively seeking collaborations with established international players to leverage their expertise and expand our reach. This allows us to tap into new markets and navigate different regulatory landscapes effectively.
- Global Certifications: We're committed to meeting the highest international quality standards. Pursuing and adhering to various certifications like ISO 9001 and FDA approvals opens doors to new markets and builds trust with global customers.
- Sustainability at the Core: We believe in responsible manufacturing practices and are constantly innovating to minimize our environmental footprint. We utilize eco-friendly materials, implement energy-efficient processes, and actively communicate our sustainability efforts to customers worldwide.



We understand that challenges are inevitable, but we at Arvico Rubber Industries believe that adaptation, innovation, and a customer-centric approach are the keys to success. We're confident that by focusing on these core principles, we can not only overcome these challenges but also establish ourselves as a leading force in the global rubber industry, exceeding customer expectations both in India and globally.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?

Arvico's Unique Selling Point (USP) in the industrial sector is a unique combination of reliability and innovation. Our products are not only of high quality and long lasting, but they are made using innovative technologies that make them more efficient and costsaving. This means our customers are not only getting a reliable product, but they are also saving money. The current market response has been positive, and we foresee a steady increase in demand over the coming years.

Give a brief stating your future investments and growth plans for the coming years?

Our future investments revolve around increasing production capacity for our sustainable rubber products. We plan to invest in research and development to further enhance the optimization aspects of our manufacturing processes and ensure that we complete the construction of our new factory very soon. Additionally, we are also making successful efforts to partner with e-commerce companies to expand our market presence globally.



Darshil Shah CEO Arvico Rubber Industries

Chemical Engineering World



Sealmatic India- "Once A SealMan Always A SealMan"



Sealmatic, with a rich legacy of 30 years, stands as a global player in the mechanical seal industry. Originating in 1989 as a small enterprise, it has evolved into a leading provider of high-quality seals, addressing complex applications across diverse sectors with a commitment to precision, reliability, and innovative solutions. **Umar A K Balwa, Founder & MD, Sealmatic India Pvt. Ltd.** gives us a brief insight to Sealmatic as we navigate through his success and global presence.

How do you see the current mechanical seal market evolving in India? What are the major factors driving its growth?

The mechanical seal market has been predominantly dominated by international players over the last five decades. The technology employed in the manufacture of mechanical seals requires high precision designing and production, which was not available in the nascent stage. Over the years, the capabilities of the industry improved dramatically and paved way for the induction of state-of-the-art technology in all the industrial fields, namely, oil & gas, refinery, power, petrochemical, chemical, pharmaceutical, fertilizer, pulp & paper, shipping, aerospace etc., thus creating huge demand for high precision mechanical seals. Mechanical seals are designed to prevent leakage of exotic and hazardous media into the environment. Consequently, increasingly stricter legislations made it mandatory for the industrial plants to employ mechanical seals for all their rotary equipments. Way back in the early 1980s, size of the mechanical seal market was merely USD 300 Million and today the same has grown exponentially to USD 3.5 Billion. The core sectors of the world economy are electricity, steel, refinery products, crude oil, coal, cement, natural gas and fertilizer These sectors have a major impact on the world economy significantly and this will be the biggest driver for growth in the mechanical seal industry.

What are the major expectations of client organizations from players in this space? How do you meet their expectations?

The major expectations of customers in this field are reliability, application know how and quick after sales & service. The mechanical seal industry is highly

competitive technically. It demands a proven track record before one serves a customer's application; hence know how to design a mechanical seal for a particular application is of paramount importance. Every mechanical seal produced is tailor made to suit the individual requirements of the customers. We are geared up and in fact the only domestic company which has invested huge amounts in R & D, Designing, and Quality Control & Production. We have a dedicated team of 40 engineers who are employed for the sole purpose of designing individual solutions for customers globally. We are proud to state that we are the only Indian company which has the distinction of API Q1, ISO 19443 (Nuclear), DGQA, ATEX & EU FDA certification for mechanical seals. Furthermore, as a domestic mechanical seal company, we are the only one that employs FEA & CFD for hard-core design and development of mechanical seals. From our experience in this field of over 35 years, our customers' benefit from the enormous data that we bring to the table in terms of application know how, trouble shooting and failure analysis. This is the key to success in this highly competitive business.

How is your company positioned in this segment?

We enjoy excellent position in this market, our range of mechanical seals is exported to over 45 countries and is as well accepted as the big names of the industry. Domestically we are second to none in our offerings; we provide a comprehensive package to our customers globally, right from the selection of mechanical seals to the installation and training of the personnel at the end user premises. Due to the knowledge and applicationbased solutions we provide for critical equipments, we are the preferred vendor for various projects globally in the core industrial sector. We have come up holding





on to a simple ideology "Once A SealMan Always A SealMan"

What are the major factors that set you apart from other players in this segment?

The mechanical seal industry is highly competitive. It requires huge amounts of time, money and energy to reach a certain level. When we started out in 2011, we consciously made efforts to set up our plant to match international standards and specifications, not only in terms of employing hardware and software, but also by implementing very high international standards and a highly trained team. We are proud to state that we have more than 100 visits from international customers to our premises and all of them have simply defined us as a - "state of the art international facility." Moreover, if we compare ourselves with other domestic players, though we would not like to do so, the answer to this question would earnestly be that we have marched miles ahead of the domestic competition. We have got all the certifications in place which no other domestic manufacturer has, viz. API Q1, ISO 19443 (Nuclear), DGQA, ATEX, FDA etc. Also, if we consider R & D, we have invested in state-of-the-art test rigs meeting API 682 standards. The investment in these test rigs is huge, sometimes surpassing the cost of a small mechanical seal company. We have built in capabilities of FEA & CFD, unlike any other company in India in our field. We have tools such as MSD (Mechanical Seal Dictionary), SSG (Seal Selection Guide), AKH (Application Know How) and many others which have catapulted Sealmatic to the big league of international players. We are perceived and respected globally as a high-quality mechanical seal company.

How has the company been proving itself with its heavy-duty mechanical seals that offer innovative and tailor-made sealing solutions? Tell us with respect to your various product offerings. As mentioned earlier, the business of mechanical seals entails application know how, which comes through years of varied experiences in this technically competitive industry. We have devoted over 35 years in this high-octane business, which requires out of the box thinking in order to provide solutions for very difficult and complex sealing applications. Our specialty lies in designing and providing heavy duty mechanical seals for pumps, compressors, agitators and other rotary equipments. Applications where the pressure rating exceeds 100 kg/cm2, temperatures in excess of 350 degree Celsius, slurry content of very high level, media with high viscosity and so on, have been designed over the years and developed as niche products to meet the above demanding applications. These are not only difficult to design and produce but it is equally challenging to install a suitable mechanical seal in the rotary equipment with such applications. This has been achieved from the rich data bank that we have assimilated in the last 35 years, which allows us to match such demanding application to the work that we have done in the past. Plus, we employ the best of raw materials, which are imported from Germany, USA and the UK. We do not compromise on the metallurgy. Our heavy-duty mechanical seals find applications in oil & gas, offshore platforms, pipe line booster pumps, heavy duty slurry pumps, high pressure agitators in chemical plants, high temperature rotary equipments in refineries and many more such varied applications.

Elaborate on the company's 30 years of legacy which has been constantly driving its growth with the challenging needs of superior sealing technology.

Our journey in this business started in 1989 as a small enterprise with 200 sq. mtr of premises and a handful of 8 employees. Today we are housed in one of the most modern manufacturing facilities in India and can be ranked as a global player. Our journey coincidentally has been published by the company, the link for the same



is - https://www.sealmaticindia.com/once-a-sealmanalways-a-sealman.php. Over the years Sealmatic has become synonymous to mechanical seals with deliveries to more than 45 countries. The modern plant of Sealmatic has grown exponentially since the 220 square meters it was at its nascent stage. Also, we have expanded our new production unit at Kaman, Vasai. Above all, every colleague is proud to be a part of this journey and the company. Anything more we add here about a company such as Sealmatic, which is growing every day will be premature. It's proven to us that a dream that is pursued with dedication earns the right to be called a vision. To future generations we would like to say that a seed sown via a relatively obscure company called A K Engineering proves to us that the name of a company can change over the years, as well as the hands running it, but its goals remain intact. We were given the privilege of watering this seed and nurturing it to its full potential, a process that is ongoing, but we trust that when its heirs enjoy the fruits they will remember where it all began. The field of mechanical seals is a dynamic, challenging and highly competitive arena. Every new application invites innovation and demands solutions. The subject involves physics, chemistry, mathematics and most importantly common sense. We developed an abiding respect for the mechanical seal business. It is a business that is critical to every industry. A mechanical seal is a vital component of rotary equipments. It implies our personal philosophy- "if you set the small things straight, the big things will fall into place".



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Umar A K Balwa Founder & Managing Director Sealmatic India Pvt. Ltd.

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Innovations in Centrifugal Pump Manufacturing: Chemitek's Stride

n the dynamic landscape of centrifugal pump manufacturing in India, the growth trajectory has been nothing short of remarkable. At the helm of this transformative journey is **Chemitek Process Equipments Pvt. Ltd**, a company dedicated to pushing the boundaries of efficiency and reliability. As the Managing Director of Chemitek, it is with great excitement that **Firoj A Mulani** announces his participation in the Chemtech World Expo 2024, where they will be showcasing their most energy-efficient Horizontal Centrifugal Process Pumps.



Chemitek's displayed Metallic and Non-metallic Centrifugal Process Pumps stand as a testament to precision and performance. Designed in accordance with ANSI (B73.1) standards, both pump achieves an outstanding efficiency. But it's not just about efficiency; it's about reliability and Performance. The Non-Metallic Centrifugal process pump, with a capacity of up to 1000 m3/hr, boasts the largest range in India for handling aggressive chemicals, with or without slurry content, at temperatures up to 210°C. Similarly, the Metallic Centrifugal process pump, with a capacity of up to 1200 m3/hr, operates efficiently at temperatures reaching up to 371°C. To complement these pumps, they will also be showcasing our Chemitek Make – IMSS/IMSD Mechanical seal.

Addressing marketing challenges in the competitive landscape of critical application pumps requires a strategic mindset. As Firoj Mulani speaks "Our industry faces a dual challenge of Costing and Quality Competition, with competitors offering substandard quality pump. At Chemitek, we place an emphasis on value rather than mere cost. Chemtek aims to highlight the superior quality, reliability, and long-term cost-effectiveness of pumps by offering customizable solutions and added features at a reasonable cost." He further states "Obtaining approvals for critical application pumps is a challenge that we at Chemitek take seriously. The challenges primarily revolve around convincing decision-makers to choose your pumps for critical applications."

At the heart of Chemitek's success lies their advanced Moulding and Casting technique employed in the manufacturing of centrifugal pumps. This technique not only ensures precision and durability but sets them apart from competitors in terms of product quality and performance. Their centrifugal pumps boast high efficiency, contributing to cost-effectiveness and energy savings for our customers. Chemitek's Energy Efficient pumps stands as a key differentiator, emphasizing the superior performance of pumps compared to industry standard.

Looking ahead, Chemitek is poised for significant expansion. They are set to establish a new manufacturing unit and office in Pune next year, contributing an additional capacity of 6000 pumps per year in Phase I. By the upcoming financial year, their yearly capacity is expected to reach 9000 pumps. In Phase II, they plan to extend the Pune facility, adding a capacity of 12000 pumps per year, resulting in an impressive yearly capacity of 15000 pumps. This visionary approach aligns with commitment to shaping the future of centrifugal pump manufacturing, offering cutting-edge customized solutions for diverse applications.

Chemitek Process Equipments Pvt. Ltd journey in the centrifugal pump manufacturing sector is a testament to our unwavering commitment to excellence. As they gear up for the Chemtech World Expo 2024, they invite you to witness the culmination of dedication to innovation, reliability, and efficiency. Chemitek, are not just showcasing pumps; they are presenting a vision for the future of centrifugal pump manufacturing. ■



Firoj A Mulani Managing Director Chemitek Process Equipments Private Ltd



Revolutionizing Manufacturing: Ideazmeet, A Pro-innovation Ecosystem

ideazmeet

ntroducing you to Ideazmeet, the pro-innovation manufacturing ecosystem that is set to transform the way ideas, innovations, and products are showcased, while completely revolutionizing the way stakeholders interact. Whether you're a buyer or a supplier, this groundbreaking platform offers you the opportunity to join and completely transform the way you connect, engage, and share ideas with countless stakeholders throughout the manufacturing value chain.

Driven by a shared passion for innovation and a deep understanding of the challenges faced by the manufacturing industry, **Kshitij Tiwari**, **the Founder and CEO of Ideazmeet**, embarked on a mission to bridge the gap between brilliant minds and practical solutions.

Our goal is to unlock the power of this virtual realm that transcends physical boundaries, immersing yourself in a fully digitalized environment where opportunities await with just a single click, eliminating any hassle and streamlining the entire business process.



Ideazmeet takes it a step further by simplifying your marketing and selling strategies, making it easier than ever to reach your target audience and boost your business.

At Ideazmeet, we aim to transform the manufacturing industry by providing a unique platform that caters to all your needs.

- Find reliable suppliers
- Launch products and innovations
- Connect with industry experts
- Target high-intent buyers
- Promote and Advertise
- Stay plugged into industry trends.

Our vision is to create a manufacturing ecosystem that seamlessly connects you with suppliers, buyers, and stakeholders, making it easier to locate and collaborate with them digitally.

But that's not all. Ideazmeet also offers a space where you can gain and share valuable insights and expertise, foster innovation, and connect with like-minded individuals who share your passion for manufacturing excellence.

And the benefits don't end there. It provides a seamless way for you to promote and advertise your products, services, and innovations, ensuring better visibility and success. ■

Website: www.ideazmeet.com



Kshitij Tiwari Founder & CEO, Ideazmeet



Mascot Systems, Scales with New Figures

Chairman , Mascot Systems Pvt. Ltd. and VP, SME Chamber of India, T.R. Varadhan is a seasoned professional with over 40 years of rich and diverse experience in engineering goods and services suited for the process industry. He started his career with Goodyear Tyres Ltd. in the year 1983. With the technical skills he possessed, he pursued his dream as a first generation entrepreneur. The initial few years were a struggle, but with his sheer determination and perseverance, Mascot Systems Pvt. Ltd. now rules the industry in the field of sealing, and in a short span of time the company grew to be a significantly sized SME.

eing a sound technocrat with immense leadership skills, Mr. Varadhan has groomed many a leader as a mentor alongside working towards higher company goals. Apart from holding such a large portfolio, he has created a brand for himself and with his professional and technical skills, he has brought in revolutionary changes in the sealing, process control and process safety industries. He has also been involved in bringing changes in rotary equipment, and revolutionized the designing of mechanical seals. He has had monumental achievement by applying for three patents in the field of bearing seals and designs for the "thinnest bearing isolators" ever created. He has been closely associated with DuPont, and has applied his expertise towards designing specialty products alongside them. In the future, Mr. Varadhan aims to ethically, profitably, and physically stimulate industry growth by delivering value, as he recounts his journey during the interview.

What is the latest technology or product you are displaying during the participation in Chemtech World Expo 2024, highlight your specialization? While we have some prestigious products in our kitty, we would like to draw your attention to 2 specific products:

Marque Bearing Seals: A bearing seal is a non-contact, non-wearing, permanent bearing protection device. It has a stator and a rotor. The stator is pressed into a bearing housing and the rotor rotates with the shaft. The stator and rotor are unitized so they don't separate from one another while in use. Marque Bearing seals protect the leakage of lubricant from the bearing housing and prevent the entry of dust or moisture from outside into the bearing housing. They can be used in process pumps, electric motors, gearboxes, plummer blocks, steam turbines, paper machine rolls, and tool spindles. We have several different types of bearing isolators, such as the magnetic type, vacuum resistant type, single and dual bearing seals, and the split type.

With a wide installation base across refineries, petrochemicals, paper, power, and fertilizers,



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Marque Bearing Seals have replaced many other leading manufacturers which are being imported and manufactured domestically, enhancing their bearing life further. Rarely, do we receive spare orders for the installed bearing seals.

Kalrez® for Chemical and Semiconductor Industries and Valve Stem Packings: DuPont™ Kalrez[®] and its many compounds are highly sought after specialty rubber used to make parts such as O-rings, V-rings, packings, and other custom shapes. These compounds, divided by their use in various applications, are highly chemically-resistant, high pressure resistant, and can withstand temperatures upto 327°C. They also have very low compression sets allowing for Kalrez® parts to have a longer lifespan their other elastomeric counterparts. They are ideal for use in the chemical, oil & gas and semiconductor industries, with numerous standard and specialized compounds tolerant of harsh chemicals such as H2S, amines and ethylene oxide, as well as resistance to plasma based environments in the semiconductor industry. Further, Kalrez® perfluoroelastomer (FFKM) parts and DuPont™ Vespel® V-rings can be used in combination with each other to form KVSP™ (Kalrez® Valve Stem Packings) that can reduce stem-based fugitive emissions and improve process control throughout the lifespan of the valve.

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

One of the biggest marketing challenges we foresee in India is to compete with local competition or reverse engineered goods. We are positioned uniquely to offer quality goods with various certifications and

manufactured using patented technologies. However, due to the intellectual property landscape in India, we often come across competitors dealing in knockoff, uncertified goods at much lower prices. We are confident that our products are technologically superior to any such knock-off goods, and in the long run, will have lower maintenance or replacement costs, thus leading to a greater return on investment. However, where we face a challenge is in having a potential customer understand such long term benefits, when it is often the case that the Indian consumer chases smaller, short-term cost savings over larger, longer-term gains. In order to ameliorate this issue, our well-trained sales force perseveringly explains to customers the benefits of going for products with superior technology, such as cost savings, requiring lesser spares, and a greater mean time between repairs. Further, we have the support of very active channel partners who are always available to answer any and all technical queries, hence allowing us to not just offer products, but instead, complete technological solutions.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?

- A product of Mascot Systems, Marque Bearing Seals, is customized to your requirements, thereby helping you cut costs drastically. Our specialist engineers will help you identify the reasons for bearing failure and design a bearing seal to ensure maximum lubrication and zero contamination. Our bearing seals are IP66 certified. By maintaining bearing seals under ideal operating conditions, the rotating equipment will last 5 to 10 times longer than without permanent bearing isolation.
- DuPont[™] Kalrez[®] parts have an increased lifespan due to their superior chemical resistance, superior pressure and temperature resistance, and their low compression sets. This leads to a longer mean time between repairs, and a reduced number of plant shut-downs, leading to direct benefit for the consumers. Further, KVSP[™] (Kalrez[®] Valve Stem Packing) increases a valve's ability to react quickly and smoothly to process changes while at the same time maintaining stem based fugitive emissions to levels as low as 1ppm, as opposed to



the industry standard of 1000ppm leakage rates. It reduces process control variability to the control system's capability, resulting in improvements to both yield and product quality on specification.

Give a brief stating your future investments and growth plans for the coming years?

In the short run, we as a company are always seeking out new and superior products that we hope to onboard and help market across the country. Our company has the advantage of being well established across several sectors such as Chemical, Oil & Gas, Petrochemical, Fertilizer and Food & Pharmaceuticals. In the near future, it is our goal to have a test bench for our various product lines, from rupture discs, to O-rings, to safety and control valves. Further, we are in the process of investing in infrastructure for skid making, and wish to provide our customers with a one-stop solution, instead of individual products.

In the long run, our vision is to be India's most preferred supplier for industrial products in Oil and Gas, Specialty Chemicals and the Pharmaceutical industries. Our mission is to add value to our customers by way of providing optimal products that will enhance the productivity of engineers across India. MSPL is looking to triple our revenue, and as an SME, support the Indian government's dream of achieving a US\$5 trillion economy.



T.R. Varadhan Chairman, Mascot Systems Pvt. Ltd. & Vice President SME, Chamber of India Revealed a start Revealed a start Ministry of Chemicals & Fertilizers Department of Chemicals and Petrochemicals, Government of India



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Chemical Engineering World



Breaking Boundaries: Daga Global's Trailblazing Chemical Innovations



Daga Global stands as a beacon of innovation in the chemical industry, harnessing cutting-edge technologies to deliver sustainable solutions. With a focus on fine chemicals, battery materials, and advanced membrane technology, **Satyen Daga, CMD, Daga Global Chemicals Pvt. Ltd.** highlights the future of chemical engineering while addressing global challenges with ingenuity and vision.

What is the latest technology or product you displaying during the participation in Chemtech World Expo 2024?

Daga Global is leveraging its extensive network across India, China, and Japan to distribute innovative chemical products and technologies to sectors such as Life Sciences - Pharma & Agro, Surfactants, EV & ESS Cell materials, and allied chemical industries. At the Chemtech World Expo 2024, we are excited to highlight our following offerings:

- Upcoming Fine & Specialty Chemicals Manufacturing Facility: We are establishing a Zero Liquid Discharge (ZLD) facility spanning twelve acres at Kurkumbh MIDC, near Pune. We have designed this greenfield project to manufacture critical intermediates, replacing imports primarily from China, and produce surfactants and castor oil derivatives. This initiative is in response to the growing global specialty chemicals market, expected to reach \$882.6 billion by 2027 with a CAGR of 5.0% from 2020 to 2027, catering to the Life Sciences and Surfactants industry's needs.
- MolSynth's Battery Materials & Technologies: Our intra-startup, MolSynth, is at the forefront of the renewable energy transition, focusing on advanced materials essential for lithium and sodium battery technologies in India. Bloomberg BNEF has projected the global lithium-ion battery market to grow from \$44.2 billion in 2020 to \$94.4 billion by 2025, demonstrating the critical role of advanced materials in this growth.

Solv8's Solvent Extraction and Filtration Membranes: We are introducing advanced membrane technology through our strategic partnership with Singapore-based SOLV8, aiming to enhance efficiency and sustainability in chemical processing. The demand for membrane technology in the chemical industry is set to increase significantly, propelled by the need for more sustainable and efficient industrial processes.

These showcases underline our commitment to providing innovative, sustainable chemical solutions, backed by over 40 years of robust distribution capabilities.

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

In navigating the competitive landscape, Daga Global recognizes the challenges in distinguishing our diverse product range and services within the rapidly expanding chemical industry. Our strategy to address these challenges includes:

- Leveraging Our Network: We will utilize our extensive distribution network to highlight the accessibility and reach of our innovative and cost-effective techno-commercial solutions to the chemical industry.
- Sustainability and Innovation: By positioning ourselves as leaders in sustainable and innovative chemical solutions, we aim to meet the evolving market demands with our comprehensive

offerings in fine & specialty chemicals, ACC (Advanced Chemistry Cells) materials, and advanced membrane technology.

 Sector-Specific Solutions: We will emphasize our tailored solutions across various sectors, showcasing our ability to meet niche market demands effectively.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?

Daga Global's USP is rooted in the synergistic integration of our diversified operations, which collectively offer unmatched innovation, sustainability, and quality:

- Fine and Specialty Chemicals: Our expertise in delivering high-quality, innovative chemical solutions for a wide range of applications.
- MolSynth's Battery Materials: Addressing the increasing demand in the renewable energy sector, specifically for batteries in the electric vehicles and energy storage systems.
- Solv8's Advanced Membrane Technology: Sets new benchmarks for efficiency and sustainability in chemical processing.
- Market-Driven Approach: Our market-driven approach is aligned with significant growth prospects in specialty chemicals, battery materials, and membrane technology sectors, positioning us to capitalize on the robust demand in both global and Indian markets.
- In the fine & specialty chemicals sector, India's market is expected to expand at 12-13% annually over the next five years.
- MolSynth, our battery materials division, taps into the lithium-ion battery market, which is anticipated to reach USD 94.4 billion by 2025, growing at a CAGR of 16.4%. This aligns with India's escalating demand for electric vehicles and renewable energy storage, supported by government initiatives like PLI, NEMMP and FAME.
- Meanwhile, Solv8's advanced membrane technology addresses the need for sustainable chemical processing, with the global membrane technology market expected to hit USD 15.8 billion

by 2024, growing at a 9.1% CAGR. These figures underscore Daga Global's strategic alignment with key industry trends towards sustainability and innovation, positioning us to meet the robust and growing demand in global and Indian markets across our operational sectors.

SPECIAL

The demand for these products is robust and growing, driven by global shifts towards sustainability and the increasing need for advanced chemical materials and processes.

Give a brief stating your future investments and growth plans for the coming years?

Daga Global's future is marked by significant investments aimed at enhancing our technological capabilities and expanding our market presence.

- Our Fine and Specialty Chemicals Manufacturing Division exemplifies our innovation and quality commitment.
- We are also advancing in the green and new energy chemicals sector through MolSynth, focusing on essential battery materials and technologies. This is pivotal for supporting the renewable energy transition.
- Furthermore, our partnership with Solv8 in advancing solvent extraction and filtration membrane technology underscores our dedication to sustainable and efficient chemical processing solutions.

These strategic investments and initiatives position Daga Global as a pioneer in the chemical industry, leading the way in innovation, sustainability, and efficiency. ■



Satyen Daga CMD Daga Global Chemicals Pvt. Ltd.

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Volfram: Revolutionizing Steam Engineering





n the dynamic landscape of industrial innovation, few companies exhibit the relentless commitment to excellence and sustainability like Volfram. Since its inception in 2012, Volfram has been at the forefront of steam engineering, revolutionizing the industry with ground-breaking products and unwavering dedication to customer satisfaction. Volfram highlights innovative solutions that are shaping the future of steam engineering worldwide.

Innovative Products Driving Change:

V Wise TM Smart Boiler Controllers: These intelligent controllers redefine boiler data monitoring and control by harnessing connectivity and advanced analytics. This controls the boiler operation digitally and provides elaborated data for analysis which enables customer to optimize boiler performance minimize energy wastage and ensure seamless operation. The upcoming "V Wise +" promises even greater efficiency and reliability.

Vapomax Pump: "The Compact Condensate & Flash Steam Recovery System": Debuting at the Chemtech World Expo 2024, Vapomax unlocks significant energy savings by harnessing the energy in condensate and flash steam. It reduces environmental impact and sets new standards for sustainability in steam engineering.

Essential Steam Accessories:

Steam Traps: Essential for removing condensate and non-condensable gases, steam traps prevent steam leakage, ensuring efficient steam utilization. These steam traps contribute to energy conservation and operational efficiency.

Heat Cool / Hot Water Generation Systems: These customized systems are designed to provide effective heating or cooling as per process demand. It uses single fluid for heating as well as cooling which avoids cross contamination of utilities, improves production and quality by gradual heating and cooling of the product.

TDS Based Boiler Blow-Down System: This system uses high pressure and high temperature TDS sensor to measure the TDS of boiler water online and the smart microprocessor based controller with unique algorithm help take corrective action to maintain boiler TDS within limit and protect boiler from scaling.

Pressure Reducing Stations: Pressure reducing stations regulate steam pressure for optimal performance, preventing equipment damage and ensuring safety. They improve process efficiency and reduce operational costs.



Customer-Centric Approach:

Volfram's commitment to customer satisfaction extends beyond product innovation. The company offers customized solutions tailored to specific industry requirements, delivering tangible results and fostering meaningful partnerships. With comprehensive support and proactive engagement, Volfram ensures the success of its clientele.

Global Approach:

Looking ahead, Volfram's vision for the future is one of expansion and innovation. With plans to establish a robust dealer network across India, the company is poised to reach new heights and serve a broader clientele. Moreover, Volfram's unwavering commitment to customer service excellence and product innovation ensures that it remains at the forefront of the industry, driving positive change and shaping the future of steam engineering for generations to come.

However, navigating the intricacies of the modern marketplace presents its own set of challenges. In an era dominated by digital communication and virtual interactions, establishing meaningful connections with customers remains paramount. Volfram acknowledges this challenge and remains committed to bridging the gap through personalized engagement and proactive outreach. By leveraging its extensive network and industry expertise, Volfram aims to foster meaningful partnerships and drive mutual success in the everevolving landscape of steam engineering.

Volfram's journey from inception to industry leader is a testament to its dedication to excellence, sustainability, and customer-centricity. As industries worldwide embrace the transformative potential of steam engineering, Volfram remains at the forefront, driving positive change and shaping the future of steam engineering for a brighter, more sustainable tomorrow. With its innovative products and unwavering commitment to customer success, Volfram continues to inspire change and set new standards of excellence in the industry.



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Chemical Engineering World



A Journey from Pioneering Fluoropolymer Solutions to Multiple Facilities



From its modest inception in 2004, with just one workshop specializing in Fluoropolymer Coating, **Advanced Expertise Technology Pvt. Ltd.** has grown exponentially over the past 19 years. Today, boasting eight manufacturing units spread across India (Mumbai, Gujarat, Vizag, and Hyderabad) the company has garnered significant recognition in the field. Offering expertise in various pharmaceutical and chemical equipment and services, the company is now poised to expand its presence on the global stage. **M H Choudhary, Managing Director,** offers a glimpse into the company's journey as they prepare to showcase their capabilities at Chemtech 2024.

What is the latest technology or product you are displaying during the participation in Chemtech World Expo 2024?

During our participation in Chemtech World Expo 2024, we are thrilled to unveil our latest technological innovations and products, focusing primarily on our expertise in Fluoropolymer Coating/Lining, Drying Equipment, Controlling Systems, Filter Equipment, Heavy Equipment, and Formulation Equipment & Mesh Welding. As a leading supplier in these domains, we are proud to showcase our cutting-edge solutions designed to meet the evolving needs of various industries including API, Bulk Drug, Pharmaceutical, Food, Fine Chemical, Inorganic Chemical, Petrochemical, Ore, and Surface Treatment.

What marketing challenges do you anticipate in India and globally, considering the competitive landscape, and how do you plan to position your offerings?

In both the Indian and global markets, we anticipate significant marketing challenges due to the competitive landscape, particularly in terms of pricing and timely delivery. With numerous players vying for market



share in various product categories, securing orders becomes increasingly challenging for all involved. To address these challenges and effectively position our offerings, we prioritize several key strategies. Firstly, we recognize the paramount importance of competitive pricing while ensuring that our pricing remains attractive without compromising on quality. By closely monitoring market trends and optimizing our production processes, we aim to offer competitive prices that resonate with our target audience.

Moreover, we understand that timely delivery is crucial for maintaining customer satisfaction and loyalty. As such, we have implemented robust logistics and supply chain management systems to ensure prompt delivery of our products. By streamlining our operations and fostering strong relationships with suppliers, we minimize the risk of delays and uphold our commitment to reliability. In addition to competitive pricing and on-time delivery, we place a strong emphasis on delivering superior quality and customer-oriented services. By prioritizing customer satisfaction and actively seeking feedback, we continuously refine our offerings to better meet the evolving needs of our clientele. Overall, our approach to addressing marketing challenges revolves around providing value-driven solutions that prioritize customer satisfaction, quality, and reliability. Through these efforts, we aim to differentiate ourselves in the marketplace and establish a strong position amidst stiff competition, both domestically and globally.

What is the Unique Selling Proposition (USP) of your product, and what is the current and projected demand for it in the market?







The Unique Selling Proposition (USP) of our product lies in our ability to offer fluoropolymer coated equipment with a comprehensive service approach. Unlike many competitors who may specialize solely in fabrication or coating services, we distinguish ourselves by providing both under one roof. This integrated offering streamlines the process for our customers, offering convenience, efficiency, and consistency in quality across the entire production cycle. Our ability to handle both fabrication and fluoropolymer coating in-house not only simplifies logistics but also ensures seamless coordination and compatibility between these crucial stages. This comprehensive service approach underscores our commitment to delivering end-to-end solutions that meet the highest standards of quality and reliability.

Interms of market demand, the current landscape reflects a growing need for corrosion-resistant equipment across various industries such as pharmaceuticals, chemicals, food processing, and more. As industries increasingly prioritize operational efficiency, product longevity, and safety, the demand for fluoropolymer coated equipment is projected to rise steadily.

Moreover, the global push towards sustainability and environmental responsibility further amplifies the demand for durable, long-lasting equipment that minimizes the need for frequent replacements and repairs. Fluoropolymer coatings not only offer superior corrosion resistance but also contribute to extended equipment lifespan, making them an attractive choice for discerning customers seeking cost-effective, sustainable solutions.

Looking ahead, we anticipate a continued uptrend in demand for our fluoropolymer coated equipment as industries recognize the value proposition it offers in terms of performance, longevity, and environmental impact. By leveraging our unique service proposition and staying attuned to market dynamics, we are wellpositioned to capitalize on this growing demand and drive continued growth and success in the market.

Give a brief stating your future investments and growth plans for the coming years?

In our pursuit of continuous improvement and expansion, we are committed to making strategic investments in our infrastructure and capabilities to drive future growth. To this end, we have already allocated over ₹3 Crore towards enhancing our coating facility, a move that not only boosts our production efficiency but also significantly increases output capacity. These investments represent significant а milestone in our journey towards operational excellence and cost reduction. By modernizing and optimizing our coating facility, we aim to streamline processes, improve turnaround times, and elevate the overall quality of our products and services. Looking ahead, our growth plans extend beyond facility enhancements to encompass broader initiatives aimed at expanding our market presence, fostering innovation, and diversifying our product offerings. We envision further investments in research and development to fuel technological advancements and product innovation, ensuring that we remain at the forefront of industry trends and customer demands. Additionally, we are exploring opportunities for geographic expansion and market penetration, both domestically and internationally. By leveraging our strengthened capabilities and reputation for excellence, we are poised to capture new opportunities and forge strategic partnerships that drive sustained growth and profitability in the years to come. Overall, our future investments and growth plans are guided by a steadfast commitment to delivering value to our customers, stakeholders, and communities. Through prudent investments, strategic planning, and unwavering dedication to excellence, we are confident in our ability to achieve our growth objectives and continue to thrive in an ever-evolving marketplace. ■



M H Choudhary Managing Director Advanced Expertise Technology Pvt. Ltd.

PRODUCTS

Carrier Elevates 'Make in India' Initiative with Expanded HVAC Product Line



Carrier, a renowned leader in intelligent climate and energy solutions, has bolstered its portfolio of HVAC products manufactured in India with the introduction of

Air Handling Units (AHUs) and Fan Coil Units (FCUs). These meticulously crafted units cater to the diverse needs of India's commercial buildings, offering bespoke solutions for indoor environments with stringent air filtering requirements.

This expansion reaffirms Carrier's more than five-decade manufacturing presence in India and underscores its commitment to India's growth under the 'Make in India' initiative, with a dedicated 10-year commitment. The domestically produced AHUs and FCUs not only enhance accessibility and service network but also bolster support across various channels.

Ideal for applications in healthcare, manufacturing, hospitality, and infrastructure projects including railways and airports, Carrier's AHUs and FCUs feature patented casing designs for exceptional structural integrity and improved heat transfer efficiency. Certified by Eurovent, a global leader in third-party product performance certification, Carrier's AHUs boast industry-leading performance, underscored by energy efficiency and sustainability goals.

Dhiraj Wadhwa, Director of Applied Sales and Overseas Markets at Carrier, emphasized, "The addition of AHUs and FCUs to our portfolio reflects our commitment to delivering comprehensive and sustainable HVAC solutions. As a trusted partner in the industry, we take pride in our customer-centric approach and longstanding legacy of excellence in manufacturing."

The Rise of Portable Evaporative Coolers for a Warming World

The global portable evaporative cooler market is experiencing significant growth, driven by factors such as increased environmental awareness, rising temperatures, and technological advancements. Evaporative cooling, particularly suited for hot and lowhumidity climates, is gaining popularity worldwide due to its cost-effectiveness and energy efficiency.

The market, valued at US\$2.41 billion in 2022, is projected to reach US\$3.94 billion by 2028, with a forecasted compound annual growth rate (CAGR) of approximately 9% from 2023 to 2028. Direct evaporative cooling, known for its effective and low-cost operation, dominates the market, especially in regions with hot climates. Residential applications lead the demand, fueled by the need for economical cooling solutions. Geographically, the Asia Pacific region leads the market, driven by urbanization and a growing middle class. In the US, evaporative coolers are essential for cooling during hot summers, particularly in the South and Southwestern states. Meanwhile, in Germany, government incentives promoting energy-efficient technologies have boosted market adoption.

Key players like Bajaj Electricals Limited, Honeywell International Inc., and Symphony Limited are investing in product innovation to meet growing demand. For instance, Cool Boss introduced the Coolee CL-240, a compact three-in-one portable air cooler, while Hessaire Products Inc. expanded its MC18 cooler line with new color options. As demand rises and technology advances, portable evaporative coolers are set to remain a popular choice for cost-effective and sustainable cooling solutions worldwide.

Sipcam Introduces Game-Changing Biofungicide 'Mevalone' for Grape Growers

Sipcam, a leading agricultural solutions provider, unveils 'Mevalone,' a groundbreaking biofungicide revolutionizing grape crop protection. Tailored for wine, table, and raisin grapes, Mevalone offers growers effective control over bunch rot and powdery mildew with its novel soft chemistry and unique mode of action.

Having gained popularity among European growers, Mevalone is now registered in California and 16 other states, providing a robust solution for disease management. Its curative action against spore germination and preventive benefits align perfectly with integrated disease management programs, ensuring control of Botrytis and powdery mildew under favorable conditions.

Notably, Mevalone boasts one of the lowest risks of Botrytis resistance development, classified under FRAC Group BM01 Biological. Extensively tested in university and third-party trials, it shows no interference with fermentation or aromas, making it an ideal choice for sustainable vineyard management.

With a short pre-harvest interval and reentry interval, Mevalone offers flexibility in application, accommodating diverse disease conditions each season. Its naturally derived active ingredients, including Thymol, Geraniol, and Eugenol, ensure safety and environmental compatibility while maintaining wine quality.

Formulated with Eden Research's patented Sustaine Technology, Mevalone exhibits superior efficacy over other terpene-based fungicides, providing up to a fourfold improvement while being environmentally friendly. With Mevalone, grape growers can confidently protect their crops, ensuring premium quality and sustainable practices in vineyard management. ■

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What differentiates HMT from others

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