



PILOT-SCALE FACILITIES @ CSIR-NML





PRODUCTION OF MAGNESIUM METAL

The unit is specially developed depending on the input materials and product requirements. Sponge Magnesium from the dolime/calcined dolomite can be produced at a pilot scale of 300kg. The same facility is also tested for processing of ferrochrome slag to produce the magnesium aluminate spinel refractory and high carbon ferrochrome alloy at 300-350kg pilot scale under the feasible thermodynamic condition. The Vacuum Arc Furnace at CSIR-NML is with maximum power of 350 KVA with the facility of charging raw materials under vacuum.

CSIR-NML's First BATTERY DISMANTLING & RECYCLING FACILITY

CSIR-NML has established its first Battery Dismantling and Processing/Recycling Facility, equipped with a 1 TPD (ton per day) battery dismantling unit, along with 100-litre metal extraction and 10-litre solvent extraction systems. This pilot-scale plant follows a Hire-Operate-Transfer (HOT) model, designed to support MSMEs and entrepreneurs in India by providing access to advanced battery recycling technologies and infrastructure.





E - Waste

Products



Dismantled & Classified E-waste



Facilities Developed



Lithium Salt	Cobalt Salt	Copper Sheet
Gold Metal	Cobalt Sheet	Neodymium Salt
Manganese Dioxide	Nickel Sheet	Manganese Sulfate
Silver Chloride	Pd Salt	Nd Salt
Plastics	Cobalt Chloride	Samarium Oxalate
Rare earth metals salt		Fe Pigment

URBAN ORE (E-WASTE) RECYCLING FACILITY

CSIR-NML has established the Urban Ore (E-waste) Recycling Centre to develop and demonstrate sustainable e-waste recycling technologies. The facility focuses on recovery of non-ferrous, precious, rare earth, and strategic metals from PCBs, batteries, magnets, lamps, and telecom waste. Technologies developed are energy-efficient, economically viable, and environmentally friendly. To date, 14 technologies have been successfully transferred to Indian industries under the FTT/FTC programme. This initiative supports "Swachhata Abhiyan", boosts MSME participation, and promotes employment and entrepreneurship in the recycling sector.

INERT GAS ATOMIZER (AU1000, BLUEPOWER, GERMANY)

CSIR-NML has established a state-of-the-art Laboratory Scale Inert Gas Atomizer (IGA), marking the first such installation in India, to support indigenous development of metal and alloy powders for Additive Manufacturing (AM). The facility enables the design and development of advanced alloys with enhanced properties tailored for AM applications.

It plays a key role in advancing India's self-reliance in high-performance materials and will be made accessible to industries and academic institutions for collaborative R&D in AM material development.



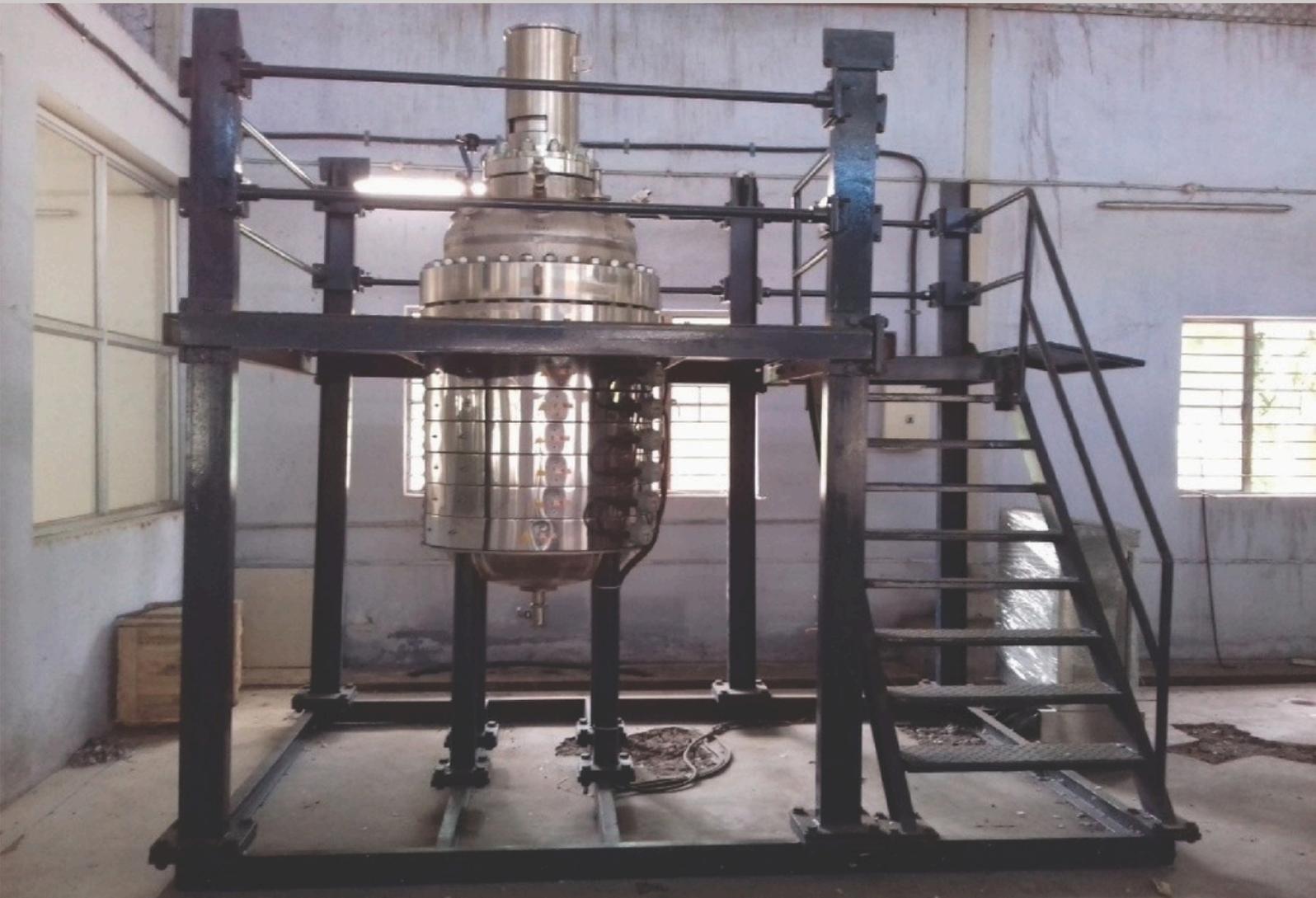


VACUUM DISTILLATION PLANT FOR SEPERATION OF METAL

The unit is specially developed depending on the input materials and product requirements. Sponge Magnesium from the dolime/calcined dolomite can be produced at a pilot scale of 300kg. The same facility is also tested for processing of ferrochrome slag to produce the magnesium aluminate spinel refractory and high carbon ferrochrome alloy at 300-350kg pilot scale under the feasible thermodynamic condition. The Vacuum Arc Furnace at CSIR-NML is with maximum power of 350 KVA with the facility of charging raw materials under vacuum.

HIGH PRESSURE AUTOCLAVE- 500 LITER

The autoclave is designed for high-pressure leaching operations at optimal temperature conditions. External heating and cooling systems are provided to ensure precise temperature regulation. A heavy-duty motor, powered by a three-phase electrical supply, is integrated to enable rotational movement, promoting uniform mixing and effective leaching. The autoclaves are suitable for carrying out reaction under reducing, oxidizing and inert atmosphere.





TITANIUM AUTOCLAVE -30 LITER

The autoclave is used for high-pressure leaching processes at optimal temperatures. External heating and cooling systems are integrated to maintain precise temperature control during operation. The autoclave is equipped with a heavy-duty motor for rotation, powered by a three-phase electrical supply, enabling uniform mixing and efficient leaching.

PUSHER-TYPE REDUCTION FURNACE

The pusher-type reduction furnace is designed for the reduction and roasting of heavy metals, such as tungsten, under optimal pressure and temperature conditions. The furnace is constructed with refractory bricks and a stainless steel outer body, ensuring durability and thermal insulation. It features integrated heating and cooling systems that can be operated in both automatic and manual modes. Material is charged into the furnace using a movable tray on one side and discharged via a cooled tray on the opposite side, allowing for continuous processing. A dedicated gas station provides controlled gas injection and includes a system for safe removal of generated gases, supported by an efficient fume extraction facility.





ROTARY OXIDATION FURNACE PILOT PLANT

The rotary oxidation furnace is designed for the thermal oxidation of metal powders and other materials under controlled temperature and atmospheric conditions. The furnace operates on a continuous rotary mechanism, ensuring uniform heat distribution and consistent material movement throughout the process. Its construction includes a zig-zag stainless steel (SS-310) rotating chamber, supported by a robust 10 mm thickness (SS) outer shell. Heating is achieved through externally mounted electric elements, and temperature control is maintained through advanced PID systems. The furnace is equipped with adjustable speed rotation, allowing precise control over residence time and material exposure. It also features an integrated gas injection and exhaust system to handle oxidation atmospheres and remove by-products safely, supported by a fume extraction unit.

LEACHING PILOT PLANT

The Leaching Pilot Plant is designed for the hydrometallurgical processing of metal-bearing materials through controlled leaching operations. The plant is equipped with reactors and process vessels constructed from corrosion-resistant materials, ensuring compatibility with a wide range of acidic and alkaline leaching solutions. Heating and agitation systems are integrated to maintain optimal reaction conditions and ensure thorough mixing of the material and leachant. The facility also includes filtration, solid-liquid separation, and solution handling units, allowing for efficient recovery of leach liquor. Precise process control systems enable monitoring of temperature, pH, and pressure to ensure consistent performance.





MINERAL PROCESSING

Mineral Processing Pilot Facility integrates cutting-edge beneficiation technologies for comprehensive mineral research and industrial-scale validation. The gravity separation unit features advanced centrifugal concentrators (Falcon, Knelson, Kelsey Jig) and spiral separators for high-efficiency recovery of fine precious and base metals. Our magnetic separation suite includes high-intensity dry/wet systems (WHIMS, SLon VPHGMS) for processing hematite, chromite, and rare-earth minerals. The froth flotation system enables precise mineral separation via hydrophobicity control, ideal for sulfides and oxides. For agglomeration studies, the facility houses a chamber-type induration furnace and RI/RDI/TDI testers to simulate blast furnace conditions for iron ore pellets. Material characterization is supported by compression testers, air permeability analyzers, and petrological microscopes for detailed mineralogical analysis. Additionally, specialized coal/coke testing equipment (CRI-CSR, plastometer/dilatometer) ensures quality assessment for metallurgical applications.