CSIR-Institute of Minerals & Materials Technology

Enhancing the Material Resource Security & Sustainability of the Nation
Mineral reserves of Odisha constitute nearly 20% of the India’s minerals.

Iron ore, Chromite, Bauxite, Coal, Manganese, Limestone, Graphite, etc.

Emerging Academic Hub
Mineral Processing
- Iron ore
- Graphite
- Beach sand
- Manganese
- Chromite
- Coal
- Bauxite
- PGE
- Lithium/ Tungsten

Metal Extraction
- Seabed Minerals
- W, Co, Ni, V etc. from secondaries
- Rare/ Energy critical elements
- Membrane Separation
- Process intensification

Advanced Materials
- Industrial waste
- Water
- Bioremediation
- Bio-energy
- Societal: Energy efficient Chulha, Driers, Building Materials etc.

Environment & Sustainability
- Industrial coating
- Energy Materials
- Advanced Materials
- Plasma Processing
- Design & Process Engineering
- Instrumentation

Engineering Support

Mandate: Sustainable Development of Mineral & Material Resources
Graphene to Graphene Based Materials

- **Process knowhow:** Developed for production of (i) Flaky, (ii) high purity graphite and (iii) graphene
- **ECF earned:** Rs. 125 lakhs; Additional Rs 25 lakhs and royalty expected.
- **Patent:** Jointly with TATA Steel
- **Process knowhow transferred to** M/s. Pradhan Industries, Odisha.
  - We are negotiating with
    - M/s Chandan Minerals
    - Gimplex Pvt. Ltd.
    - M/s TAMIN Chennai
COBALT & NICKEL

Resources

• Lack of Primary Resources
• Low Grade Resource: Nickel-bearing chromite overburden of Sukinda (Co ~0.03%, Ni ~0.7%)

Ni Technology Pilot Plant

‘Co- Technology’ at Rubamin Ltd., Baroda
Production of Tungsten Components for Defense

India does not have economically exploitable Tungsten resources.

Entire domestic requirement of Tungsten is met by imports.

Total Global Known Economic Deposits (2014)

- China: 57%
- Russia: 14%
- Canada: 8%
- USA: 9%
- Austria: 5%
- Vietnam: 4%
- Other: 3%

CSIR-IMMT will provide basic Engineering package to DMRL, Hyderabad for:
- Production of 1.5 tonnes of Tungsten metal powder/day
- Processing of 100kg tungsten alloy scrap

Optical micrograph of 1500°C sintered 95W-3.5Ni-1.5Fe
RECYCLING & REUSE OF STRATEGIC & INDUSTRIAL WASTE

Palladium recovery from High Level Liquid Waste (HLLW) generated during processing of spent nuclear fuel, IGCAR, Kalpakkam

Recovery of metal and critical elements from industrial waste like Fly ash, Red mud, Copper plant Sludge. REE and other values like Titanium carbide, Tellurium, Vanadium, Gold, Silver etc. can be recovered.

Recycling of industrial salt effluents to recover alkali and acid for integrating RE elements extraction, HWB, Mumbai

Electrochemical diaphragm cells for processing merchant grade phosphoric acid, HWB, Mumbai
Novel Coatings for Industrial Applications
(Anti-corrosion/ Anti-wear/ Hydrophobic/ Anti-scaling/Thermal Barrier)

Deposition condition
Suspension: 1.5 wt% Al₂O₃ in ethanol
Applied voltage: 100 V DC
Time of deposition: 15 sec

Uncoated Coated

Catridge heater

Bare Steel Coated Steel

Well coated edge Coated part within hole
Coatings activities at CSIR-IMMT

Coating Facilities
- Plasma-spray Coating
- High Velocity Oxy-Fuel (HVOF)
- Cold Spray Unit
- Electrophoretic Deposition (EPD)
- Sol-gel Coating
- Dip-coating
- Spin coating
- Sputtering

Characterization
- Scratch tester
- Nano-indenter
- Airjet erosion tester
- Electrochemical Workstation
- High temperature tribometer

Applications
- Ceramic coating on metals for corrosion prevention
- Thermal barrier coating
- Tribology application
- Solid oxide fuel cells (SOFC)
- Hydrophobic coating
- Organic-inorganic hybrid materials
- Biocompatible coatings
- Functionally graded materials
Column Flotation Pilot Plant for Iron Ore at Essar Steel, Kirandul; JSPL, Barbil; Tata Steel, Joda
Pellet Size Analysis, Mill & Hydro-cyclone Control

Pellets (spherical balls) of 6 to 18 mm diameter

Size Monitoring by Eye-on-Pellet @ TATA
Eye-on-Pellet

**Approach**
Real-time image processing
Size distribution trend Generation
Industrial Trial, Patent Filed
Technology Transfer

**NI Engg. Impact**
Award’14
(Runners up)
Technology Licensed to
SVNT InfoTech Pvt. Ltd. Hyderabad

**JSW, Bellary PP1 ordered 7 EYP**
Expert Eye-on-Pellet

One expert Control system is ordered by JSW-Bellary through SVNT Technology
SMART monitoring of ball mill

- Wear of Lifter and Liner
Wireless Thermocouple

- Temp monitoring of Rotary kiln
- Temp monitoring of travelling grate
SMART Induration Furnace control

Industry 4.0

IoT

and

AI
Low Cost Moisture Monitoring

• Non-Contact
• Cost: 2-3 Lakhs
• Online on conveyor
Conveyor Monitoring: Feed Rate

[Image: Graphs showing feed rate over distance, with images depicting laser and camera modules in a conveyor setup.]
Monitoring Hydro-Cyclone Choking

Ball mill Condition Monitoring

For monitoring of:
- Mill Fill level
- Mill stabilization of a continuous mill
- Particle size inside the mill

Typical vibration signal in frequency domain and ANN training