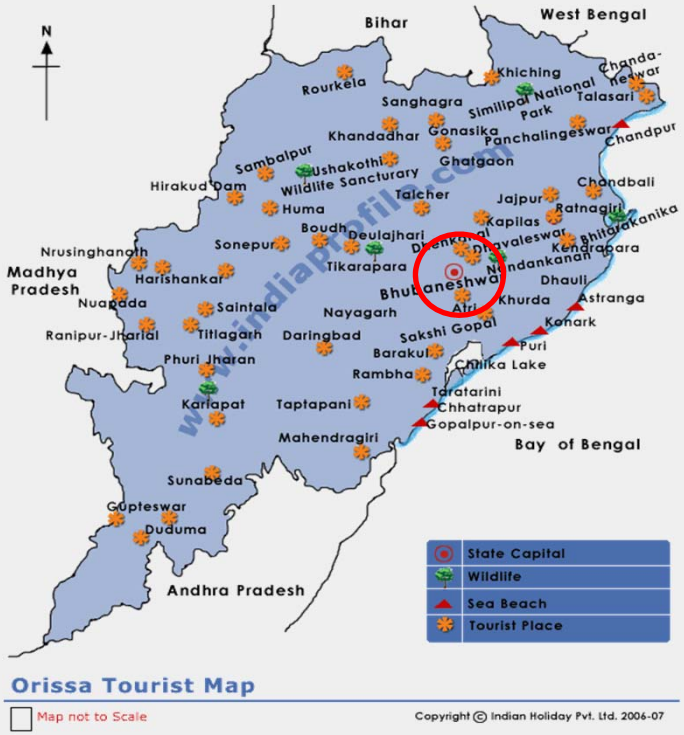
CSIR-Institute of Minerals & Materials Technology

Enhancing the Material Resource Security & Sustainability of the Nation

About Odisha



- Mineral reserves of Odisha constitute nearly 20% of the India's minerals.
- Iron ore, Chromite, Bauxite, Coal, Manganese, Limestone, Graphite, etc.
- Emerging Academic Hub

CSIR – Institute of Minerals & Materials Technology

Mandate: Sustainable Development of Mineral & Material Resources

Mineral Processing → Metal Extraction → Advanced Materials → Environment & Sustainability → Engineering Support

Mineral Processing

- Iron ore
- Graphite
- Beach sand
- Manganese
- Chromite
- Coal
- Bauxite
- PGE
- Lithium/ Tungsten

Extractive Metallurgy

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

Environment & Sustainability

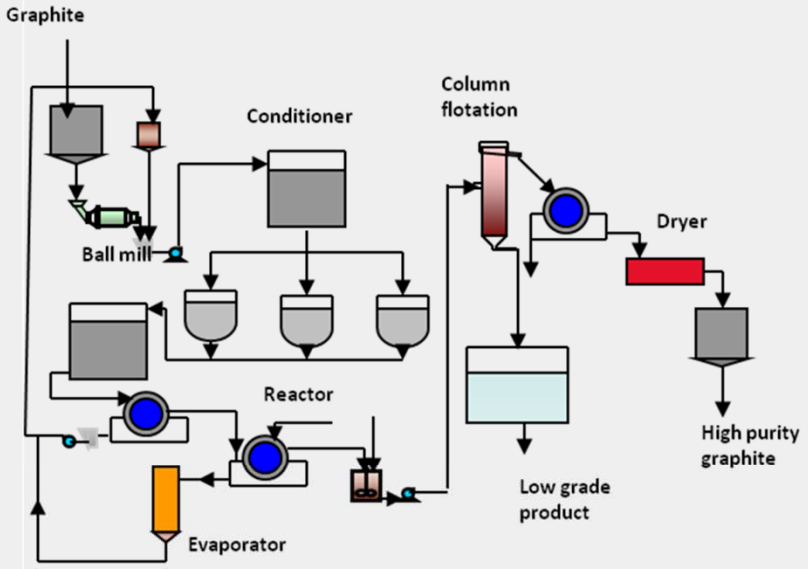
- Industrial waste
- Water
- Bioremediation
- Bio-energy
- Societal: Energy efficient Chulha, Driers, Building Materials etc.

Advanced Materials & Engineering

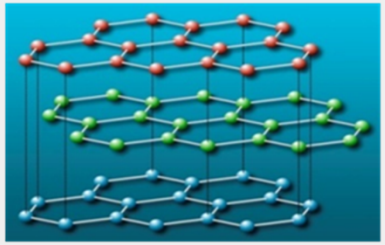
- Industrial coating
- Energy Materials
- Advanced Materials
- Plasma Processing
- Design &Process Engineering
- Instrumentation

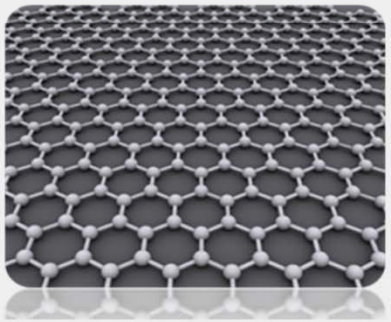
Graphene to Graphene Based Materials

- **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



Graphite rock to Graphene

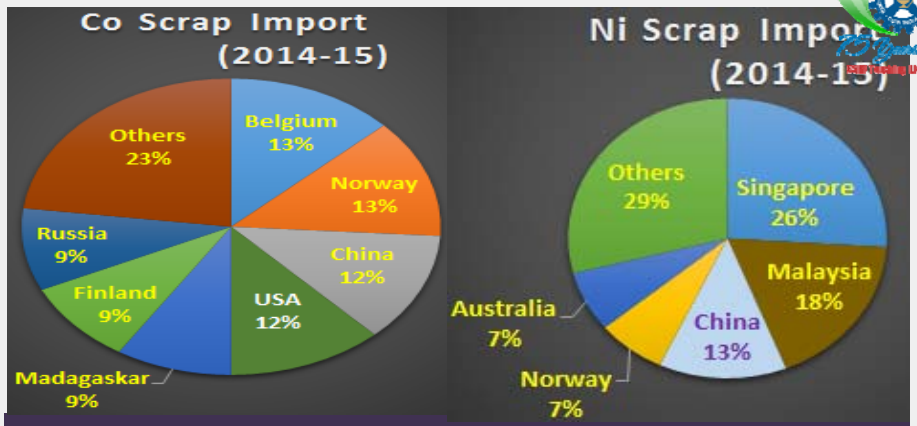




COBALT & NICKEL

Resources

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



Co: 865 tonnes, Ni: 76,200

Ni Technology Pilot Plant

'Co- Technology' at Rubamin Ltd., Baroda

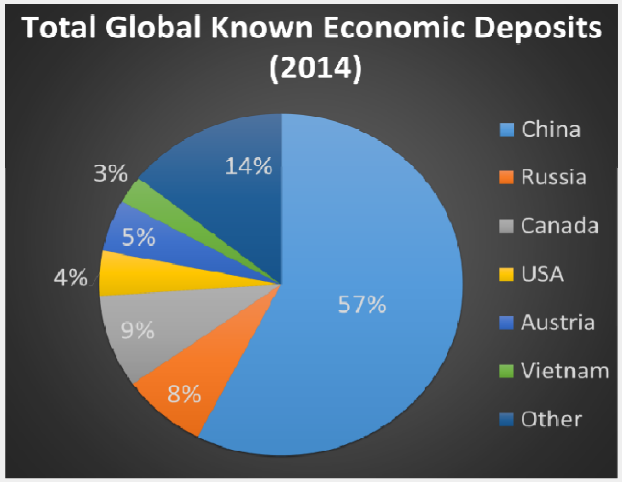
PROCESSING OF TUNGSTEN BEARING MATERIALS

Entire domestic requirement of Tungsten is met by imports.

Hutti gold mine tailings
0.02% WO_3 (0.2 g WO_3/kg)

W Scrap
90-92% W

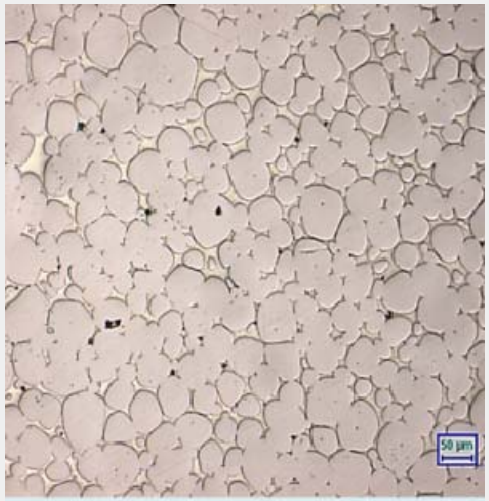
India does not has economically exploitable Tungsten resources.



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**

Production of Tungsten Components for Defense



Optical micrograph of 1500°C sintered 95W-3.5Ni-1.5Fe

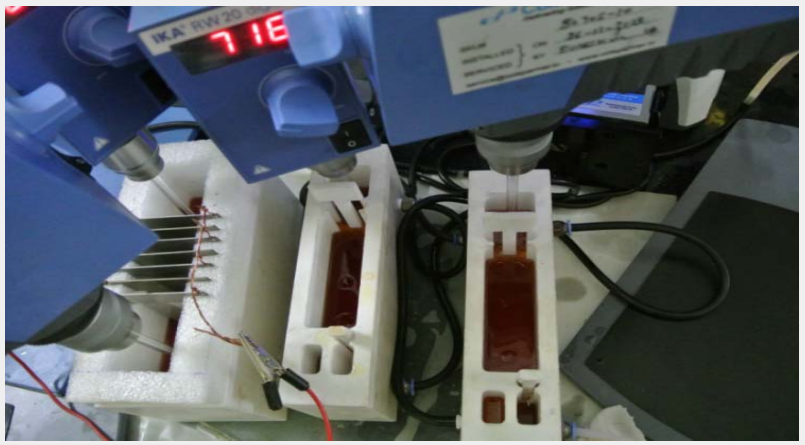
RECYCLING & REUSE OF STRATEGIC & INDUSTRIAL WASTE

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.

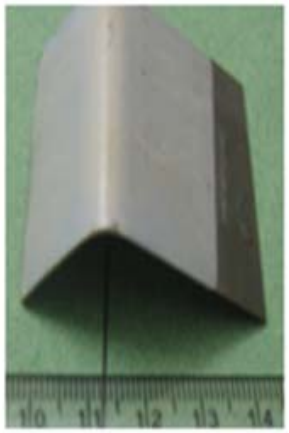
Recycling of industrial salt effluents to recover alkali and acid for integrating RE elements extraction, HWB, Mumbai

Electrochemical diaphragm cells for processing merchant grade phosphoric acid, HWB, Mumbai



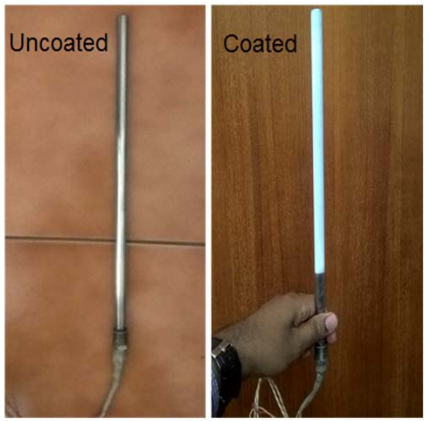
Novel Coatings for Industrial Applications

(Anti-corrosion/ Anti-wear/ Hydrophobic/ Anti-scaling/Thermal Barrier)



Deposition condition

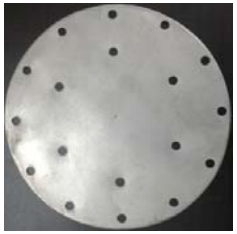
Suspension :1.5 wt% Al_2O_3 in ethanol
Applied voltage :100 V DC
Time of deposition: 15 sec



Bare Steel

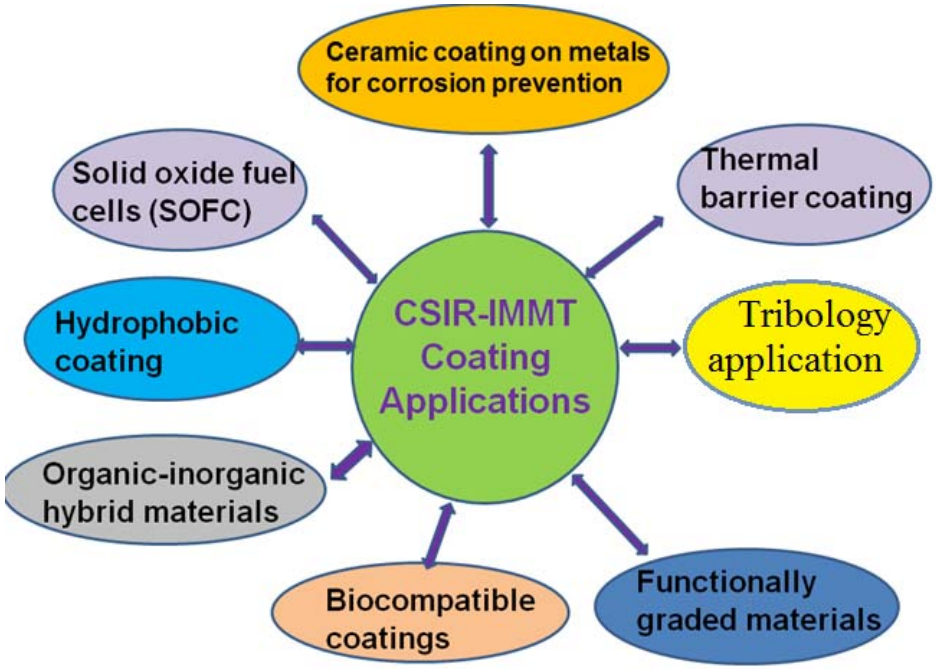
Coated Steel

Well coated edge



Coated part within hole

Coatings activities at CSIR-IMMT



Applications

Coating Facilities

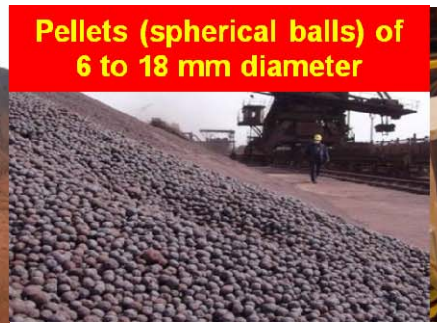
- Plasma-spray Coating
- High Velocity Oxy-Fuel (HVOF)
- Cold Spray Unit
- Electrophoretic Deposition (EPD)
- Sol-gel Coating
- Dip-coating
- Spin coating
- Sputtering

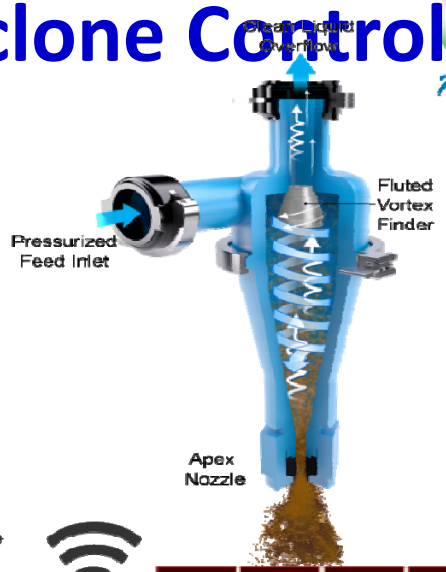
Characterization

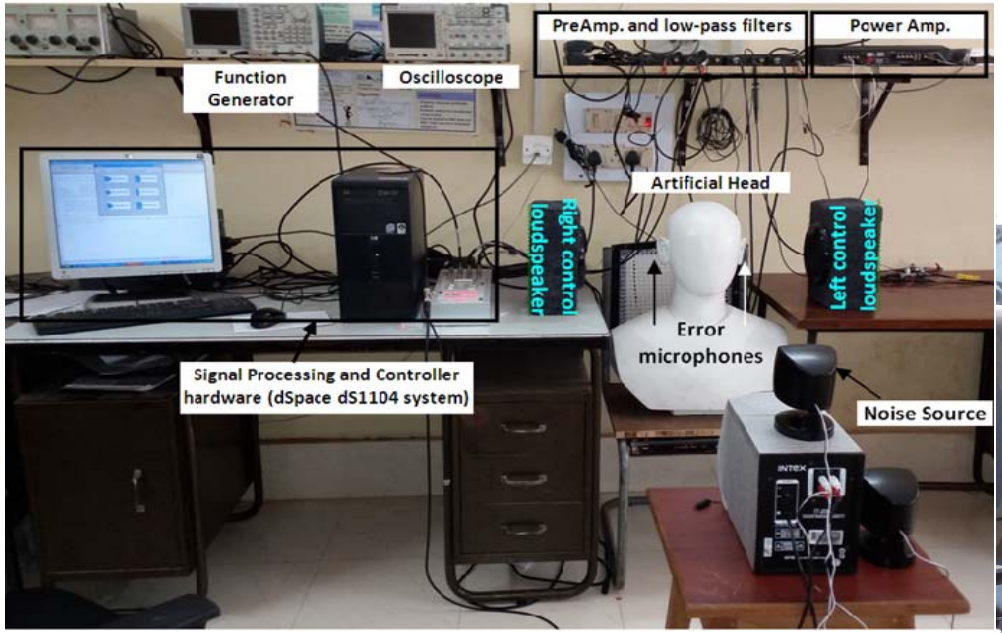
- Scratch tester
- Nano-indenter
- Airjet erosion tester
- Electrochemical Workstation
- High temperature tribometer

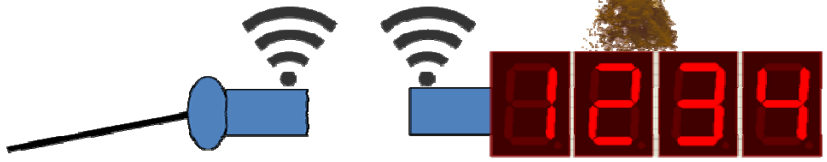
Column Flotation Pilot Plant for Iron Ore at Essar Steel, Kirandul ; JSPL, Barbil ; Tata Steel, Joda

Pellet Size Analysis, Mill & Hydro-cyclone Control









Eye-on-Pellet

Approach

Real-time image processing

Size distribution trend Generation

Industrial Trial, Patent Filed

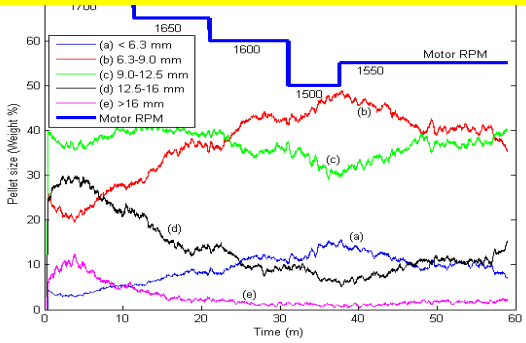
Technology Transfer

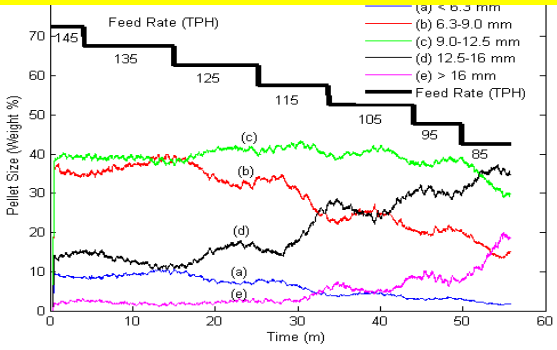
NI Engg. Impact Award'14 (Runners up)

Technology Licensed to SVNT InfoTech Pvt. Ltd. Hyderabad

JSW, Bellary PP1 ordered 7 EYP

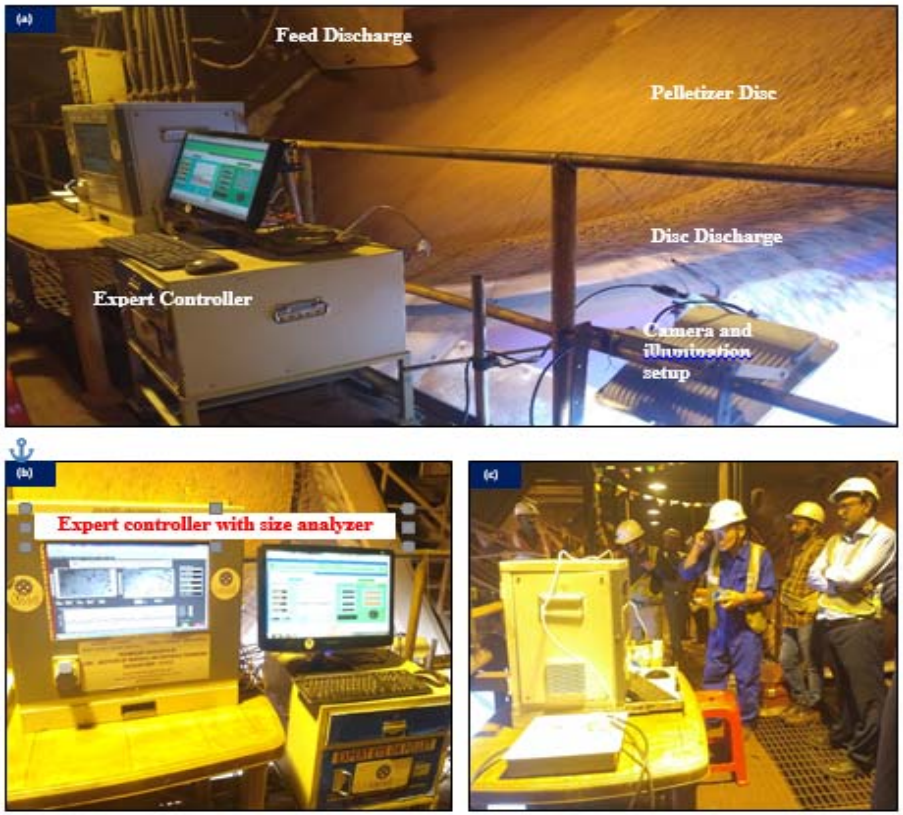
Size Distribution trend Results

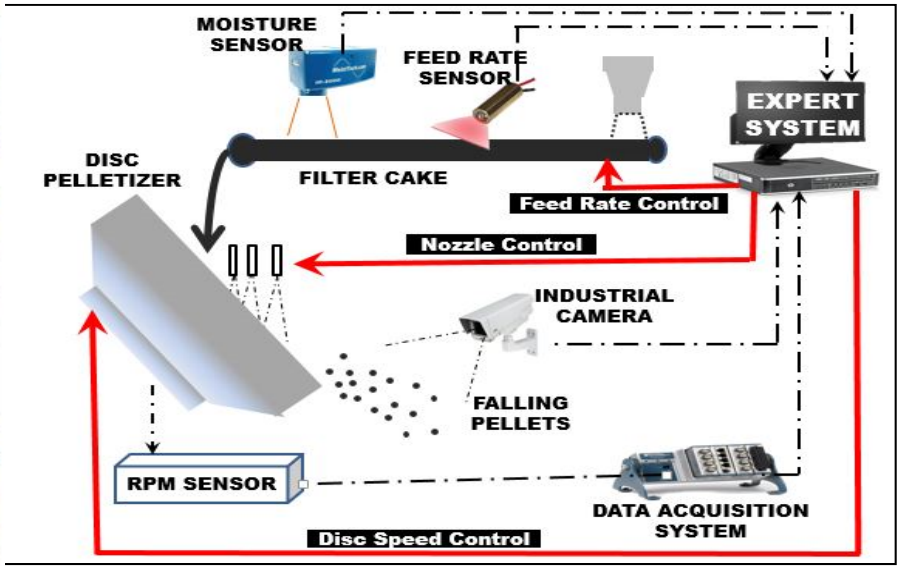




Variation of Disc Speed **Variation of Feed Rate**

Expert Eye-on-Pellet

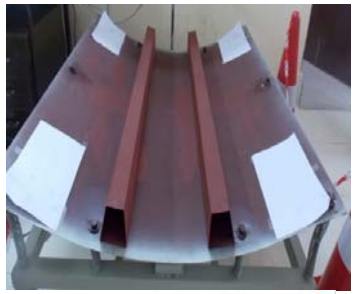


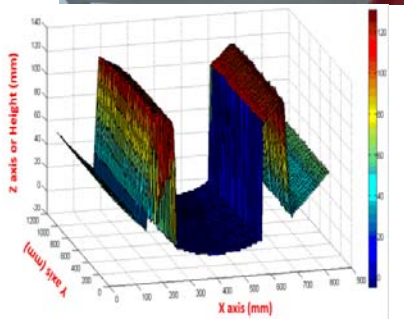


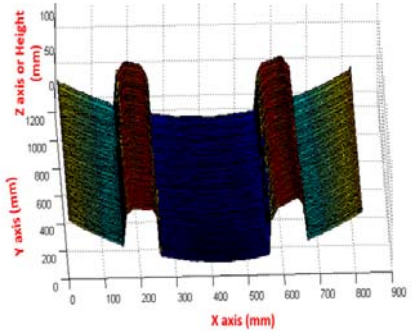
One expert Control system is ordered by JSW-Bellary through SVNT Technology

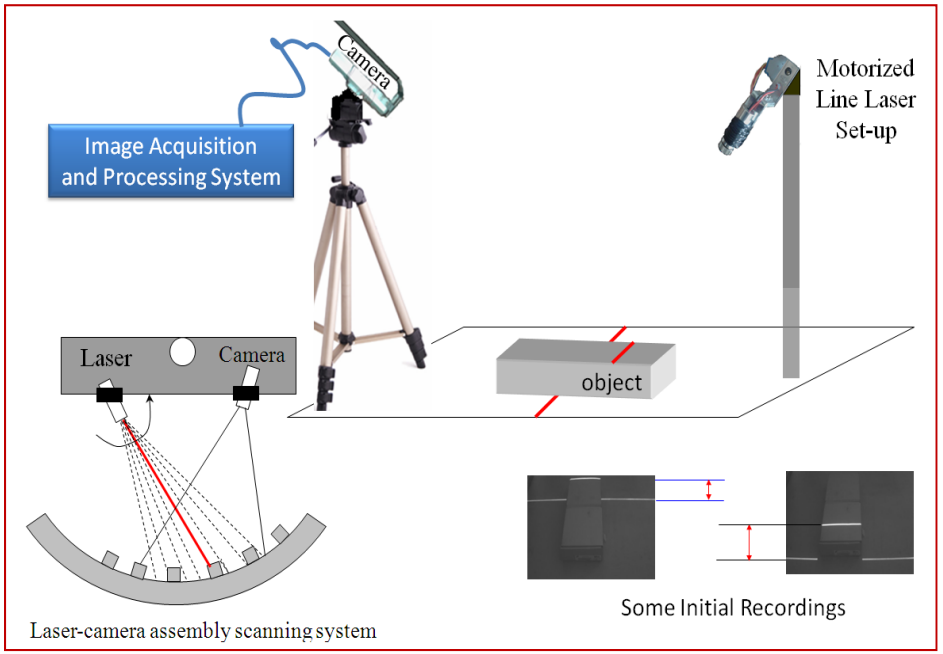
SMART monitoring of ball mill

- Wear of Lifter and Liner



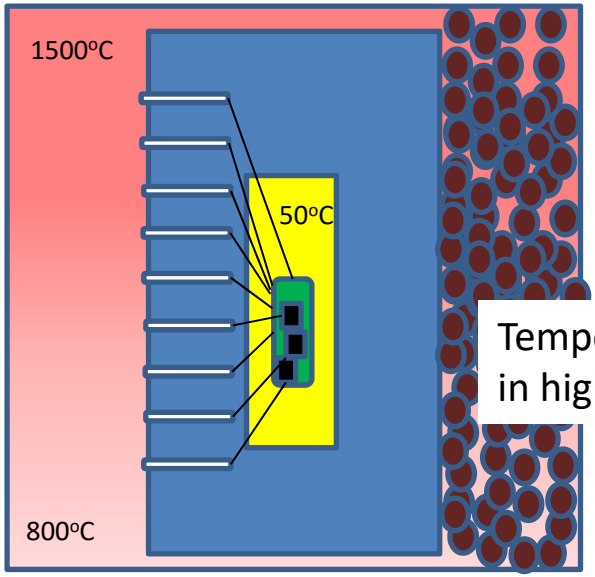






Wireless Thermocouple

- Temp monitoring of Rotary kiln
- Temp monitoring of travelling grate



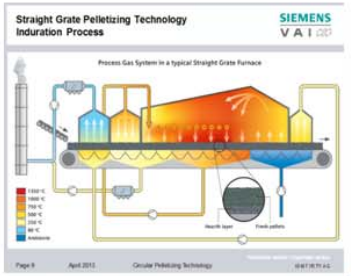
Temperature Recorder in high temp zone

Wireless Temperature monitoring

SMART Induration Furnace control

Industry 4.0

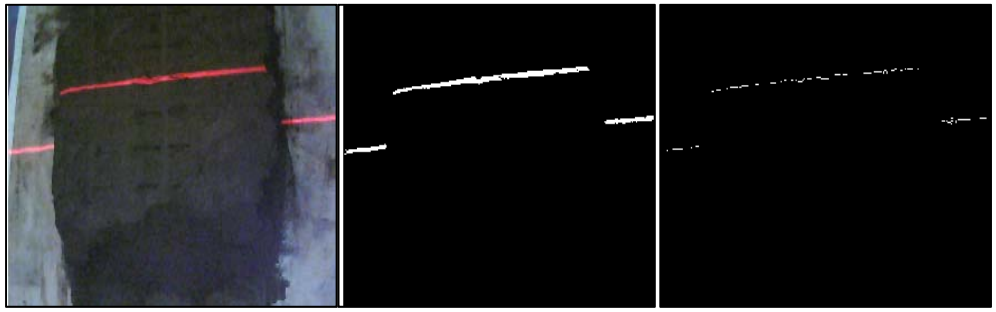
IoT and AI

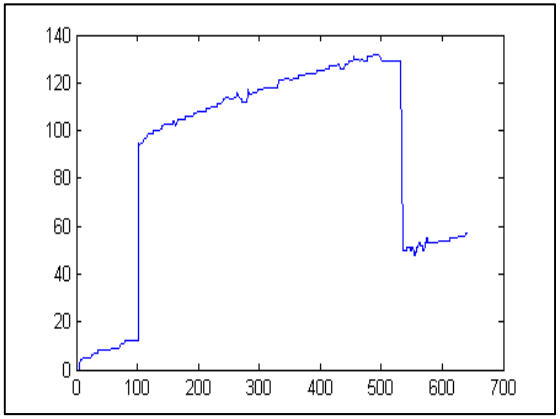


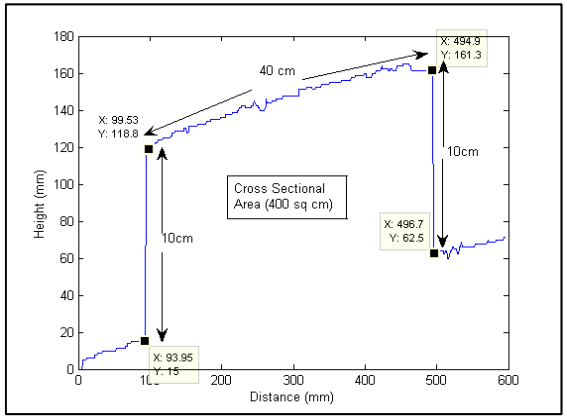
Low Cost Moisture Monitoring

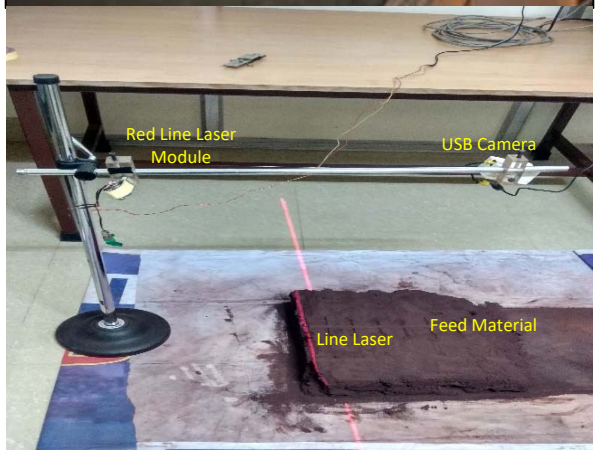
- Non-Contact
- Cost: 2-3 Lakhs
- Online on conveyor

Conveyor Monitoring: Feed Rate

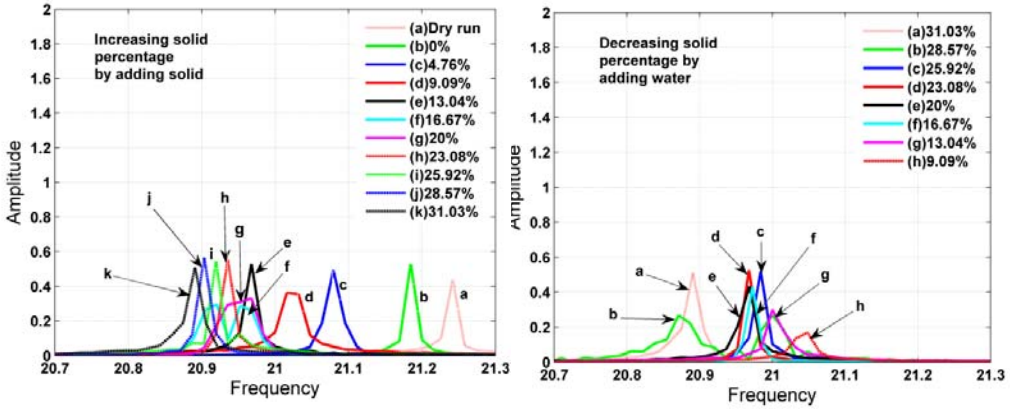


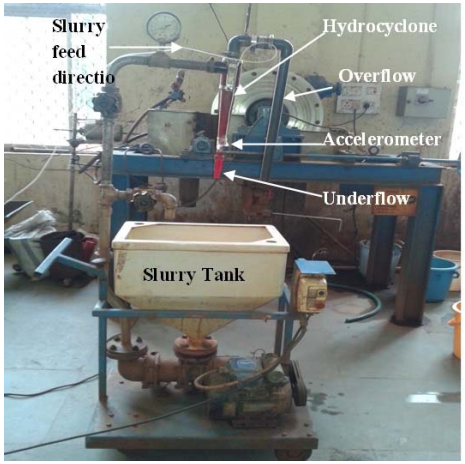


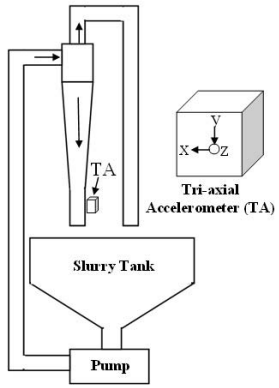




Monitoring
Hydro-Cyclone Choking







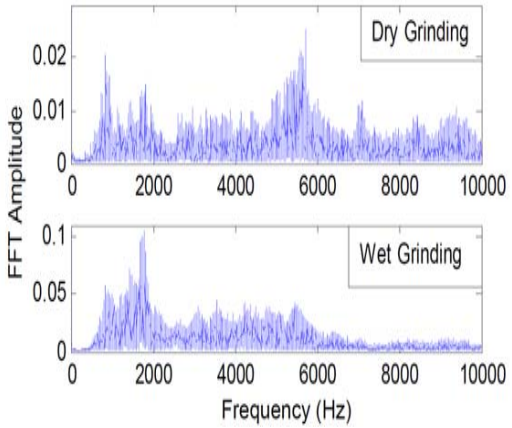
D.K. Nayak, D.P.Das*, S.K.Behera, S.P.Das, J.K.Sadangi, **Prevention of Hydrocyclone Choking Through Detection of Sub-Hz Frequency Shift of Vibration Signal**, accepted in Journal of Vibration Engineering & Technologies, Springer [https://doi.org/10.1007/s42417-019-00107-2], May 2019

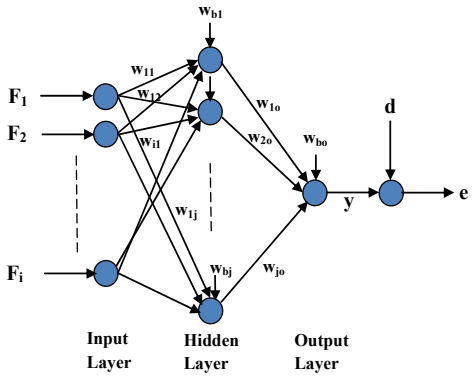
Ball mill Condition Monitoring

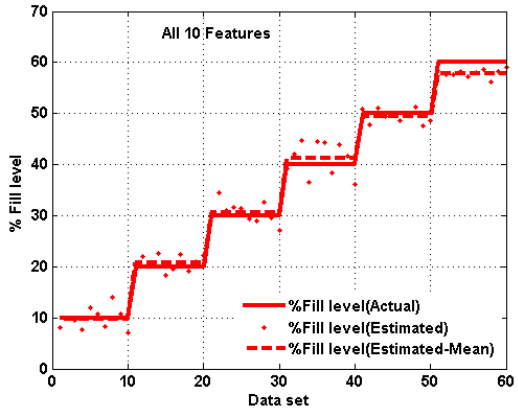
For monitoring of

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

Typical vibration signal in frequency domain and ANN training







Thank You!

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