



Process Metallurgy Lab of Iron and Steelmaking

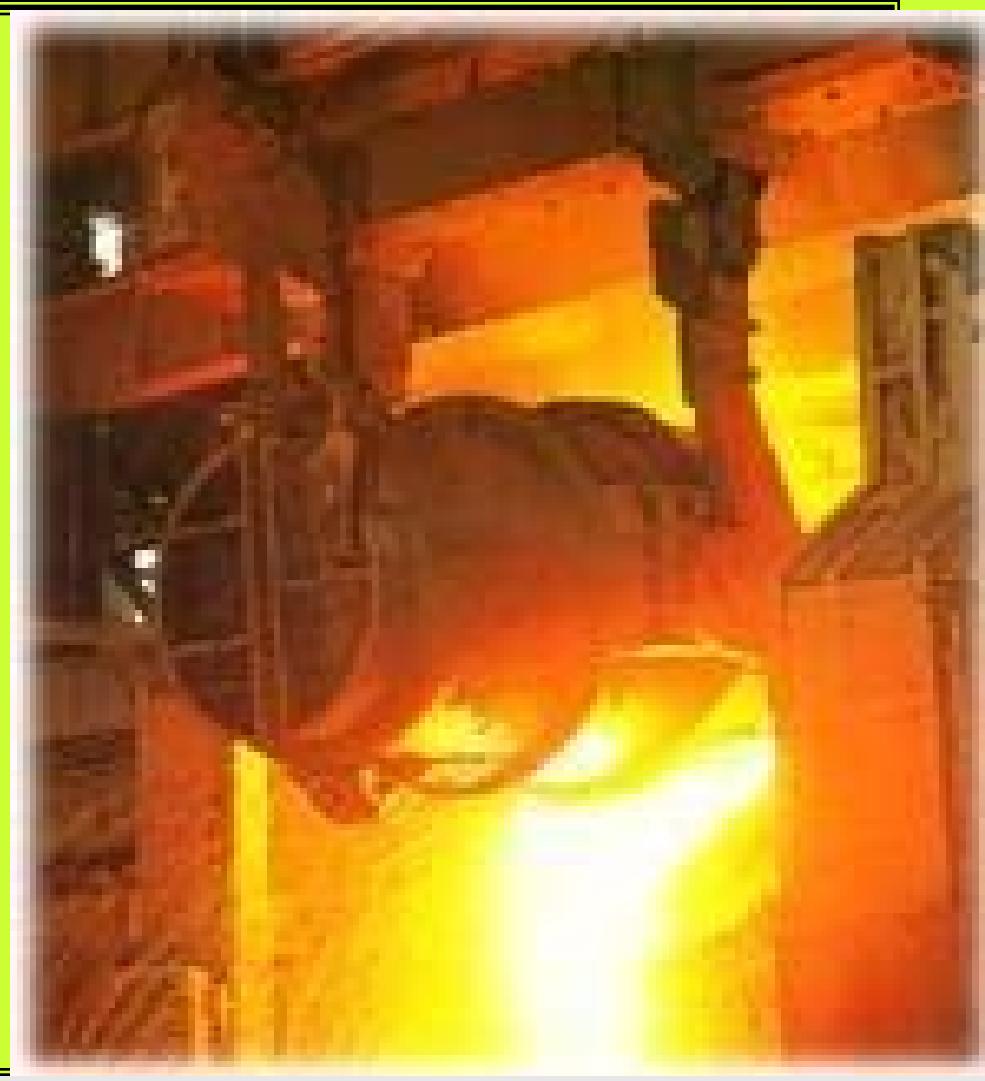
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The research activities of my group are based upon the understanding of the process, reactions, reaction mechanism and associated kinetics, thermodynamics and mass and heat transfer controlled transport phenomena in high-temperature processes related to ferrous as well as non-ferrous extraction. The research covers mathematical modeling of high temperature industrial process as well as their validation with the laboratory/plant data by fundamental as well as data-based/AI based approaches which can help to design, optimize and control the existing as well as new processes.

Research Themes:

1. Application of Quantitative Approaches in Process Metallurgy of Iron and Steelmaking: Thermodynamic and kinetic modeling of high temperature reactors using intelligent methods and techniques
2. Translational Research: Development of new innovative technologies based upon lab experiments, followed by bench/pilot scale applications.

Projects Undertaken:

1. Dry slag granulation process for energy recovery and clinker production (Also supported and funded by Ministry of Steel, under Govt. of India)
2. Microwave assisted reduction roasting based beneficiation of lean quality iron ore and coal fines. (Supported by Ministry of Human Resources/JSW Steel, NMDC Ltd.)
3. Static and Dynamic control of BOF Steelmaking process. (JSW Steel)
4. Development of dynamic control model for RH degassing process. (JSW Steel)
5. Data based models (ANN-GA based) for steel plant process control. (JSW Steel)
6. Development of Expert system for COREX Iron-making process. (JSW Steel)
7. Heat Transfer and Fluid Flow Modeling of Twin-Roll Casting Process
8. Mathematical Modeling of MIDREX Iron-making Process and its Industrial Validation
9. Data Based Modeling Approach to Control Iron and Steelmaking Process
10. Optimization of Steel Plant Supply Chain using Innovative AI techniques



A. Experimental and Testing Facilities:

(a) In the laboratory:

1. High temperature Hybrid Microwave heating furnace (1700C)
2. High temperature controlled atmosphere Horizontal and Vertical Tubular furnace (TGA assisted) (1700 C)
3. 20 Tons Cold pressing machine
4. Muffle furnace (1700 C)
5. CO Generator tubular furnace
6. Gas Analyzer (CO, CO₂, H₂, O₂ and CH₄)
7. Sieve analyzer
8. 5 Kg jar mill



(b) In the Department:

1. High speed camera – FASTCAM SA4 – 500K C3
2. Quanta 400 FEG SEM
3. Panalytical XRD (up to 1600 C)
4. Vacuum induction melting furnace
5. Open air induction furnace (2 kg)
6. TGA/DSC (up-to 1600



B. Computing facilities

Department: FactSage,
METSIM, PyroSim
Institute: MATLAB,
ANSYS-Fluent

