Separation of fine and ultra-fine particulates in fluid medium: fundamentals and applications in mineral and coal processing

Overview

Processing of Mineral and Coal has gained considerable significance in recent years because of the increasing need to treat more and more inferior grade of raw material. Inferior grade necessitates fine crushing and fine to very fine grinding. Typical examples are 0.7-1.0% Copper ore ground to -60 micron; -100 micron iron ore fines and slimes, low volatile coking coal requiring "pre-cleaning" crushing definitely to -13mm and possibly to -6mm. Processing equipment mostly involve particle motion through water and separation between particles of differing size and density takes place as a result of the interplay of body forces (gravitation or centrifugal), drag forces and particle inertia. Equipment design and performance, therefore, rely heavily on the dynamics of particles in flowing fluid which is very often turbulent. Efficiencies of the processing equipment drop significantly with decrease in particle size as the differences in relative settling velocities between the particles to be separated in water becomes minimal and the rheological behavior of the fluid medium also changes. Therefore, an urgent need has arisen to understand the fine and ultra-fine particulate separation behavior in a dynamic fluid medium from a fundamental view point to improve the knowledge in separation characteristics of the particulate matter, to better design the equipment and to improve the operational performance of the existing equipment.

The course will have following two modules.

(1) Fundamental: Definition of fine and ultra-fine particulates; Particle size, density and their distribution; Important unit operations in mineral and coal processing; Governing laws of fluid motion; Movement of solids in fluids; Suspension rheology; CFD – basics;

(2) Industrial Applications: Slurry flow in grinding mills; Particulate separation in classifiers, centrifugal separators and enhanced gravity concentrators; Examples on CFD applications; Optimization of closed circuit grinding operations; Performance improvement of separation equipment; Equipment design and selection - the role of fluid mechanics; Flow sheet development for particulate processing – examples from iron ore slimes and coal fines processing.

Participants will learn these topics through lectures and tutorials. Case studies and assignments will be shared to stimulate research motivation of participants.

Modules	1: Fundamentals December 7 – 12, 2015
	2: Industrial Applications December 14 – 18, 2015
	Number of participants for the course will be limited to fifty
You Should **Attend if ------**	▪ You are involved in plant design and selection of equipment in the area of processing of particulate matter including coal and mineral ▪ You are involved in technical sales of processing and handling equipment ▪ You operate particulate matter processing plants including coal and mineral ▪ You are a teacher, student or researcher in the area of processing of particulate matter
Fees	**Participants from abroad : US $500** **Industry/ Research Organizations: Rs 30000** **Academic Institutions: Rs 10000** The fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Éric Climent received his PhD in fluids mechanics in 1996. He was lecturer at the University of Strasbourg (1997–2001). He then moved to Brown University (U.S.A.) as a visiting professor in applied mathematics. He returned to Toulouse in 2003 to work in the chemical engineering laboratory. Since 2008, he has been a member of the Fluids Mechanics Institute, developing his expertise on the modelling and simulation of disperse two-phase flows (suspension flow, solid/liquid separation, bubbles, and drops in turbulent flows). He is now Director of IMFT, France and the head of a Master program devoted to Fluids Engineering for Industrial Processes.

Sumantra Bhattacharya is currently Tata Steel Chair Professor in the Department of Fuel and Mineral Engineering of Indian School of Mines Dhanbad. He is a member of the editorial board of International Journal of Coal Preparation and Utilization and is at present working on the effect of feed characteristics on the performance of coal cleaning units.

Kaushik Sengupta is a mechanical engineering graduate from Jadavpur University in the year 1984. Presently a fellow of the institution of engineers India. Currently working as Vice-president and H.O.D design and engineering for Tega industries ltd. Possessing thirty years of experience in the fields of mineral processing and bulk material handling; starting from design & selection of equipment/review of application engineering/ analysis of plant operation & process controls.

Suman Chakraborty is a Professor in Mechanical Engineering Department of IIT Kharagpur. His research work is focusing on the transport over miniaturized scales, along with the agglomeration of the science of microfluidics with the complex biophysics of *in-vitro* and living systems. He is an author of more than 250 numbers of highly rated International Journal publications. He is the recipient of the Santi Swarup Bhatnagar Prize. He is also the youngest Fellow of the Indian National Academy of Engineering (FNAE), a Fellow of the National Academy of Science (FNASc), a Fellow of the American Society of Mechanical Engineers (FASME), along with other awards and recognitions.

Arun Kumar Majumder is an Associate Professor in Mining Engineering Department of IIT Kharagpur. His research interests are in the areas of coal and mineral processing, fine particulate processing and solid-fluid interactions.

Course Co-ordinator

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