

Theme Area	#	Title	Champion
Fine Particle Processing	1	Coupled Electrostatic/Magnetic precipitators	RK Rath
	2	Feedback and control for mineral beneficiation	
	3	Failure of granular materials	
	4	Design and development of dry beneficiation equipment for beneficiation of iron ore fines	
	5	Machine learning process for improving process efficiency in mineral processing	
	6	Hydrocyclone Hydrodynamics	
	7	Modeling & scale up of fine particle separation for designing continuous column flotation cell	
Advanced Separation Processes	8	Carbon molecular sieve membrane for gas separation	D. Mishra
	9	Nano-structured membranes for leaching	
	10	Surfactant/Micellar Enhanced Emulsion Liquid/Ionic Liquid Membranes (ELM) for Separation of Heavy Metals (As, Pb, Cd, Cr etc.)	
	11	Hybrid Processes (Nano Filtration and Reverse Osmosis/Salting-out) for Separation of Highly Soluble Inorganic Salts from Industrial Effluents	
	12	Bulk Separation of Chemically Similar Metal Duets (Ni & Co, Mo & W, etc.) by Smart Precipitation/Adsorption Techniques	
	13	Separation of PGMs (Pt, Pd, Rh, Ir), REEs (into light and heavy groups) by Supported Liquid Membrane Techniques.	
	14	Rapid Extraction and Separation Processes (for precious and rare metals) by Resin-in-Pulp (RIP)/Multiple Emulsion Systems	

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Advanced Materials Engineering	15	Hydrophobic and self-healing coating on ceramic or metals	L.C. Pathak
	16	Sn replacement coatings on Steel substrates	
	17	Corrosion resistant hard polymer coatings for salt carrying container application	
	18	Ca-oxalate bio-mineralization in simulated body fluid	
	19	Physico-chemical nature of metallic elements in Ayurvedic medicine	
	20	Nano-composites for pulsed power capacitors (for rapid charging of batteries to be used in hybrid / electric vehicles)	
	21	Design and synthesis of exquisite bio-ceramics and composite with high strength	
	22	Bio-ceramic Inks for elastic bone implants through 3d printing	
	23	Heat-tempered, high strength- rare earth free Mg alloys for biodegradable implants	
	24	Ti based HEA for bio implants with low stiffness	
	25	HAP powder through mechanical alloying	
	26	Rare earth coating for RFI shielding/corrosion inhibition/thermal degradation	
27	HEA as thermoelectric generator material		

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<b>Advanced Manufacturing Technology</b>	28	Fracture/ Structure – property correlations/ phase transformation of nano-materials	S.G. Chowdhury
	29	Material Property anisotropies in Additive manufacturing	
	30	Applying non-equilibrium thermodynamics to iron making, steelmaking or unit processes thereof	
	31	Thermodynamic-kinetic approaches for the quantitative correlations of microstructure and mechanical properties in materials processed within non-equilibrium regime	
	32	Hot forging for making ceramic tiles from mineral and metallurgical wastes	
	33	Thermodynamics and kinetics in thin films	
<b>Environment, Energy and Resource management</b>	34	Selective catalytic reduction of NO <sub>x</sub>	Sanjay Kumar
		35	
	36	Iron reduction from Cu slag/ IF slag and similar slag and subsequent use of remaining molten silica/ alumina-silicates for developing glass ceramics by controlling casting, nucleation and growth parameters	
	37	Development of dry geopolymer cement from fly ash (no liquid activator)	
	38	Carbon sequestration with industrial waste [steel slag, waste lime sludge, cement waste, etc] by microbial induced calcite precipitation	
	39	Hybrid geopolymer for lightweight fire resistant composite	
	40	Synthetic granite from reaction sintering of mining and metallurgical waste	

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Modeling, Simulation, Big data and IOT	41	IOT for high temperature processes / hazardous environments/ in steel making	Nilima Roy
	42	Fine tuning empirical laws by big data analytics	
	43	Granular computation applied to metallurgical databases/ phenomena	
	44	Numerical Modeling of Microbiologically Induced or Influenced Corrosion (MIC)	
	45	Thermal modeling of the Solar Water Disinfection device	
	46	Phase field modelling for design of novel microstructure during solidification and TMP of advanced materials	
	47	Multi-scale computational design of new materials using first principle calculation	
	48	The Materials Genome Initiative	
	49	Digital twinning for structural health monitoring	