THERMO-MECHANICAL AND THERMO-CHEMICAL PROCESSES

TYPE OF COURSE: Rerun | Elective | PG/UG
COURSE DURATION: 8 weeks (20 Jul'20 - 11 Sep'20)
EXAM DATE: 27 Sep'2020

PROF. VIVEK PANCHOLI
Department of Metallurgy and Material Science
IIT Roorkee

PROF. S. R. MEKA
Department of Metallurgy and Material Science
IIT Roorkee

PRE-REQUISITES: Mechanical Metallurgy, Physical Metallurgy, Basic Thermodynamics
INDUSTRIES APPLICABLE TO: SAIL, TATA steel, Essar Steel, BHEL, JSW steel, Hindalco, TataMotors, Larsen & Toubro

COURSE OUTLINE:
Phase constitution and the dispersion of various phases in solids decisively influence the properties of materials. Size distribution of various phases in solids can be tailored by understanding and optimizing the solid state phase transformations in solids. Phase transformation can be influenced by coupling the heat treatment either by introduction of mechanical energy into solids or by altering the chemistry of solids. Accordingly several Thermo Mechanical and Thermo Chemical processes treatments have been developed by the researchers. This course is designed to provide the fundamental science behind these processes so that optimal utilization of these processes is possible.

ABOUT INSTRUCTOR:

Prof. Sai Ramudu Meka is working as a faculty in the Department of Metallurgical and Materials Engineering, IIT Roorkee. He obtained his bachelor of engineering degree in Metallurgy from NIT, Surathkal in the year 2002. Then he served as a Junior Manager for Jindal Vijayanagara Steels Ltd.(JVSL), Toranagallu, Bellary, Karnataka. In 2004 he left JVSL to pursue his master's studies in Metallurgy and Materials science at IIT Kanpur.

COURSE PLAN:
Week 1: Introduction, Hot deformation processes I & II, Flow curves as a function of strain rate and temperature, Stress, strain, strain rate sensitivity
Week 2: Microstructural evolution, Recovery,Recrystallization ,Dynamic recrystallization, DDRX,CDRX, GDRX
Week 3: Texture, Deformation texture (BCC), Deformation texture (FCC), Recrystallization texture (BCC), Recrystallization texture (FCC)
Week 4: Constitutive analysis, Low strain rate , Medium strain rate, High strain rate
Week 5: Deformation maps, Processing maps, Different models, Interpretation, Processing maps micro structure correlation
Week 6: SPD based thermo-mechanical processes, Friction stir Processing, Equal Channel Angular Processing, High pressure torsion
Week 7: Introduction to Thermo chemical surface treatments, Thermodynamics of Gas/solid equilibrium,Kinetics of reactions; heterogeneous reactions at surfaces and inward diffusion into solids
Week 8: Nitriding treatments; Gaseous/salt-bath/plasma,Carburizing treatments;Pack/ Gas/ Plasma/ Salt-bath, Low temperature processes for stainless steels