

MATERIALS PROCESSING

Introduction to metal casting processes, moulding methods, material and processes with special references to patterns, sands and binders. Solidification of short & long freezing range alloy castings, segregation during casting: its effect and remedial measures; gating and feeding/ risering of castings. Melting practices for ferrous and non-ferrous alloys- melting in cupola, rotary furnace, induction furnace and crucible furnace; Choice of refractory for melting furnace. Melt treatment – degassing, grain refining, filtration etc. Introduction to cast alloys – classification, microstructure and properties of cast irons, plain carbon and Hadfield Manganese steels, Aluminum based and Mg based alloys. Heat treatment of cast alloys. Casting defects and remedies, comparison of casting methods. Special casting processes, such as, Squeeze casting, Thixo-casting etc.

Introduction to metal joining processes: Principles to Soldering, Brazing and Welding. Types of fusion welding processes, gas welding, solid state welding, special welding processes, such as friction stir welding, electron beam welding and ultrasonic welding. Metallurgical principles involved in welding of carbon, alloy steels and important nonferrous alloys such as aluminum and magnesium based alloys. Welding defects and their remedies: microstructural features of Heat Affected Zone (HAZ) and their effect on mechanical properties.

Production of metal powders, recent developments in powder production, mechanical alloying. Development of nanostructures and composite materials via powder processing route. Characteristics of powders. Compaction in rigid dies, hot and cold isostatic compaction. Mechanisms involved in sintering of metal powders; application of powder metallurgy products.

Text Books

1. Principles of Metal Casting, 2nd Edition, by R W Heine, C R Loper and P C Rosenthal Tata-Mc-Graw Hill
2. Powder Metallurgy – Science, Technology and Materials by A Upadhay, G S Upadhaya
3. A textbook of Welding Technology by O P Khanna, Dhanpat Rai Publications

Reference Book

1. Welding and Welding Technology by R L Little, Tata-Mc-Graw Hill
2. Powder Metallurgy Science by R M German 2nd Edition, MPIF