ALUMINIUM BASED ALLOYS AND METAL MATRIX COMPOSITES

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PRE-REQUISITES : Basics of Materials Science & Engineering

INDUSTRY SUPPORT : TVS motors, Rane Group, Ashok Leyland, Mahindra and All other major automotive manufacturers

COURSE OUTLINE :

Aluminium and its alloys are of the most important class of engineering materials which are used in many applications starting from household to aircrafts. Given the wide range of applications of Al alloys the property requirements are also quite diverse. Therefore, understanding the structure-property correlation i.e. the Physical metallurgy of Al alloys is very important. Composites on the other hand supplement many of the properties needed in a particular application. This course will cover the aluminium alloys and their composites in the entirety. The objective is to learn about Al alloys and composites with an emphasis on the physical metallurgy and the structure-property correlation. It is expected that at the end of the course students will develop a clear understanding on Al alloys, Physical metallurgy and Metal matrix composites.

ABOUT INSTRUCTOR :

Prof. Ranjit Bauri is a Professor in the Dept. of Metallurgical and Materials Engineering, IIT Madras. He has more than a decade of experience in teaching and research. The broad areas of his expertise include Aluminium alloys, Metal Matrix Composites, Powder Metallurgy, Ceramics, Energy Materials, Friction stir welding and processing, and Microscopy.

COURSE PLAN :

Week 1: Introduction to Aluminium and its alloys, Sources and Extraction of Al, Impurities in Al
Week 2: Alloy Designations, Different series of Al alloys, Cast alloys, Al-Si alloys, Modification of Al-Si alloys.
Week 3: Wrought alloys, Strengthening mechanisms: Solid solution strengthening, Yield point phenomenon, Strain aging
Week 4: Dynamic strain aging, Serrated flow
Week 5: Alloy tempers, Precipitation hardening
Week 6: Heat treatable alloys and their precipitation sequence, Strain hardening
Week 7: Recovery and Recrystallization, Dynamic Recrystallization
Week 8: Grain refinement, Homogeneous and Heterogeneous Nucleation
Week 9: Melt inoculation, Grain refinement by melt agitation, Severe plastic deformation
Week 10: Processing of Metal Matrix Composites (MMC), Particle wetting and bonding
Week 11: Types of MMCs, Rule of mixtures, Shear Lag model
Week 12: Mechanical properties of MMCs