



MATERIAL CHARACTERIZATION

PROF. SANKARAN.S

Department of Metallurgical and Materials Engineering
IIT Madras

INTENDED AUDIENCE : Undergraduate students of Metallurgical and Materials, Physics, Chemistry and biological sciences

INDUSTRY SUPPORT : All the Metallurgical and automotive industries will be interested in this course

COURSE OUTLINE :

It is the first course at the under graduate level on microstructural characterization of materials. This course will cover the basic principles and techniques of X-ray diffraction, optical, scanning electron and transmission electron microscopy along with demonstrations of the instrument details and imaging experiments through videos. This course also deals with the sample preparation techniques for the microstructural analysis with practical examples through videos.

ABOUT INSTRUCTOR :

Dr. S. Sankaran is presently Associate Professor in the department of Metallurgical and Materials Engineering, IIT Madras. His research interests are deformation processing of materials, mechanical behavior of materials and electron microscopy. He is also presently the faculty in-charge of central electron microscopy of IIT Madras.

COURSE PLAN :

Week 1 :

1. Fundamentals of optics
2. Optical microscope and its instrumental details

Week 2 :

3. Variants in the optical microscopes and image formation
4. Phase contrast, Polarised light, Differential interference contrast, Fluorescence microscopy

Week 3 :

5. Sample preparation and applications of optical microscopes

Week 4 :

6. Introduction to Scanning electron microscopy (SEM)

Week 5 :

7. Instrumental details and image formation of SEM

Week 6 :

8. Various imaging techniques and spectroscopy
9. Sample preparation and applications of SEM

Week 7 :

10. Fundamentals of X-ray scattering
11. Bragg's law derivation and the factors affecting the intensity

Week 8 :

12. Crystallite size, effect of strain on the intensity
13. Profile fit, indexing, peak broadening

Week 9 :

- 14. Quantitative analysis, residual stress analysis
- 15. Instrumentation details and demo experiments of XRD

Week 10 :

- 16. Introduction to transmission electron microscopy (TEM)

Week 11 :

- 17. Diffraction and image formation
- 18. Various imaging techniques and spectroscopy

Week 12 :

- 19. Sample preparation and applications of TEM
- 20. Instrumentation details and demo experiments of TEM