

Electroceramics - Video course

COURSE OUTLINE

This course is an advanced level course for UG students and early PG students of Materials Science and Metallurgy. Various aspects of electronic ceramics are covered in this course which start with emphasis on how structures form in such materials. Then, defects chemistry and defect equilibria in such materials are discussed while elucidating the effect of defect chemistry on ceramic properties.

This will be followed by a treatment of defect diffusion and ionic conductivity in electronic ceramics. Once this framework is established, students will then be exposed to fundamentals and specific cases of linear dielectric as well as ferroics such ferroelectrics and ferromagnetic ceramics. Students will also be familiarized with rather novel phenomenon of Multiferroism briefly. Finally, the course will finish with emphasis on important bulk and thin films processing methods.

COURSE DETAIL

| Sl. No | Topic | Hours |
|--------|---|-------|
| 1. | Introduction | 1 |
| 2. | Crystallography: structures and structure determination | 2 |
| 3. | Bonding in solids: Difference in metals and ceramics | 1 |
| 4. | Rules for structure formation in oxides/ionic solids | 1 |
| 5. | Structures of important oxides | 3 |
| 6. | Defects in ceramics and defect chemistry | 4 |
| 7. | Defects equilibrium | 4 |
| 8. | Defects diffusion | 3 |
| 9. | Ionic and defect conductivity | 4 |
| 10. | Dielectric ceramics | 8 |
| 11. | Magnetic ceramics | 5 |
| 12. | Multiferroics | 2 |



NP-TEL

NPTEL

<http://nptel.iitm.ac.in>

Metallurgy and Material Science

Pre-requisites:

Basic course in Physics of Materials and Structure of Materials

Additional Reading:

1. Nonstoichiometry, diffusion and electrical conductivity in binary metal oxides, Per Kofstad, Wiley
2. Nonstoichiometric Oxides, O. Toft Sorensen, Academic Press
3. Electroceramics: Materials, Properties, Applications, A. J. Moulson, J. M. Herbert, Wiley
4. Transition Metal Oxides, C.N.R. Rao and B. Raveau, Wiley-VCH
5. Basic Solid State Chemistry, A.R. West, Wiley
6. Structure and Properties of Inorganic Solids, F.S. Galasso, Pergamon Press

Coordinators:

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Department of Materials and
Metallurgical Engineering IIT Kanpur

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| 13. | Preparation Methods (bulk and thin films) | 3 |
| | Total | 41 |

References:

1. Principles of Electronic Ceramics, L.L. Hench and J. K. West, Wiley
2. Introduction to Ceramics, W.D. Kingery, Wiley
3. Physical Ceramics: Principles for Ceramic Science and Engineering, Y.-M. Chiang, D.P. Birnie, W.D. Kingery