

NSE 851 Degradation of Nano-materials

Credit Hours: 3

Pre-requisites: None

Course Objectives

- To give an understanding of the basic concepts of degradation of nano-materials
- To demonstrate to graduates that corrosion and degradation of nano engineering materials is an essential area of Nano science & technology as the degradation starts at nano-level originating from the development of nano-scale electrochemical cells.
- To show that the study at nano-level helps to understand the mechanisms behind the phenomena as well as facilitates in estimating their lives.

Course Contents

- Degradation & corrosion, definition & mechanisms, types of corrosion,
- Corrosion fundamentals and electrochemical aspects
- Enabling theory of corrosion, Polarization and double layer phenomenon
- Passivity and its breakdown, Electrochemical DC corrosion testing
- E-log i diagrams, 3-electrode system and Linear polarization method
- Corrosion at nano-scale, Effect of microstructure in metals and alloys
- Degradation in polymers, Humidity and UV protection
- Nano changes in structure of polymers & Degradation in ceramics & glasses,
- Effect of temperature on degradation of polymers
- Amorphousness and crystallinity in glasses, Protection methods
- Protection by Nano-inhibitors, Types of inhibitors
- use of eco-friendly nano-inhibitors & Cathodic protection in alloys
- Degradation in biomaterials and their protection

Course Outcomes

- Better input will be provided in research projects involving degradation of nano-materials.
- Students will be able to apply their knowledge on corrosion and degradation of nano-engineering materials in the nano-industry at home and abroad.

Recommended Reading (including Textbooks and Reference books)

- Corrosion of Glass, Ceramics and Ceramic Superconductors, Principles, Testing, Characterization and Applications, David E. Clark and Bruce K. Zaitos, **1992**.
- Handbook of corrosion engineering, P R Roberge, **2000**.
- Electrochemical techniques in corrosion, Kelly et al, **2002**.
- Corrosion prevention and protection practical solutions, Sastri et al, Wiley **2007**. ISBN: 978-0-470-02402-7
- Handbook of Nanotechnology. Bhushan, Editor, Springer. **2004**. Edition: First. Pages: 1220. ISBN: 3-540-01218-4.