



Effects of Irradiation on Electronic Materials and Devices
UEA – NE512&512G/KU – ME590

Prerequisite: a basic or elementary materials course or permission of instructor.

Instructor

Prof. Carl Frahme
Kansas University
Mechanical Engineering
cfrahme@ku.edu

Required Text

Course Description

15 on-line modules, 2½ hours each [actual time]; listed below, numbered from 1 - 15. This course is designed to discuss the effects of nuclear radiation on electronics which would be used in a nuclear environment, with an eye toward enhancing safe and long-term economical operation. The course will provide better knowledge of nuclear-related electronics.

Lecture Schedule

- M1. Electrical Properties of Materials
 - L1: Electrical Conductivity
 - L2: Electrical Properties of Semiconductors
 - L3: Electrical Properties of Insulators and Ferroelectric Ceramics
- M2. Radiation Damage to Materials at the Atomic Level
 - L4: The Radiation Damage Event, Displacement of Atoms, and Damage Cascade
- M3. Radiation Damage to Materials at the Microscopic Level
 - L5: Radiation Induced Defects- Transition from Atomic to Microscopic Levels
 - L6: Phase Stability Under Irradiation
- M4. Simulating Neutron Radiation Damage in Materials
 - L7: Ion Irradiation and Simulation of Neutron Irradiation
- M5. Characterizing Neutron Radiation Damage in Microelectronics Materials
 - L8: Preparing Samples for Neutron Irradiation
 - L9: Neutron Irradiation Procedures
 - L10: Evaluating Properties and Physical Changes
- M6. Irradiation Effects on Conductors

- L11: The Effects of Irradiation on the Properties of Conductors
- M7 Irradiation Effects on Semiconductors
 - L12: The Effects of Irradiation on the Properties of Semiconductors
- M8 Irradiation Effects on Insulators
 - L13: The Effects of Irradiation on the Properties of Insulators
- M9 Irradiation Effects on Ferroelectric Materials
 - L14: The Effects of Irradiation on the Properties of Ferroelectric Materials
- M10 Irradiation Effects on Optical and Electro-Optical Materials
 - L15: The Effects of Irradiation on Optical/Electro-Optical Materials
- M11 Radiation Hardening of Electronic Materials
 - L16: Case hardening Options for Electronic Materials and Devices
- M12 Loss and Distortion of Digital Data Due to Irradiation
 - L17: Loss and Distortion of Digital Data Due to Irradiation
- M14 Irradiation Effects on Remote Sensors in Nuclear Reactors
 - L18: Irradiation Effects on Remote Sensors in Nuclear Reactors
- M15 Case Histories and New Technologies
 - L19: Case Histories Concerning Irradiation Damage
 - L20: New Technologies for Electronic Materials in the Nuclear Environment

The University of Texas has also been involved in the development of this course and has created detailed videotaping/digital-recording of all facets of preparing, neutron irradiation and measuring various important parameters to study the changes and damage. The final part of this course will include showing techniques that measure physical properties which are relevant to electronically structured materials such as those encountered in microelectronics and other solid state electronic devices.