

NUCLEAR TECHNOLOGY EDUCATION CONSORTIUM

N06 REACTOR MATERIALS AND LIFETIME BEHAVIOUR

Summary

This module describes the science and engineering of reactor materials, the factors which influence the lifetime of these materials, such as corrosion. Pressure vessel and fracture mechanics, non-destructive testing, plant monitoring and lifetime issues including the various mechanisms encountered are reviewed. Also considered is the specification and fabrication of materials for high reliability in aggressive environments.

On completion, students should have obtained:

- An understanding of the materials science structure/property relationships of key reactor materials, and how these are affected by corrosion and microstructure degradation.
- An understanding of the methods of structural integrity assessment of reactor pressure vessels.
- The ability to perform basic structural integrity assessment using the R6 code.
- An appreciation of the methods of non-destructive testing and plant monitoring.
- An appreciation of the factors which limit the lifetime of reactor components
- An appreciation of the specifications and methods of fabrication for high reliability in aggressive environments.

Syllabus

This module consists of lectures, supported by tutorials and laboratory work. The course content comprises

- Materials Science and Engineering
 - Structure of Materials
 - Corrosion
 - Usage of Different Materials
- Mechanics and Lifetime
 - Pressure Vessel and Fracture Mechanics
 - Non-Destructive Testing and Plant Monitoring
 - Lifetime Issues
 - Materials Specification and Fabrication for high reliability in aggressive environments

The lectures are supported by tutorials and laboratory work, which include:

- Corrosion Tutorial
 - Introduction to real examples of corrosion failures
- Structural Integrity Assessment Tutorial
 - Introduction to the R6 software through worked examples and problems.