Nuclear Fuel Performance

NE 591-604, Spring 2020

Instructor:

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Class Meetings:

125 Withers Hall

Tu/Th: 10:15-11:30 am

Office Hours:

W: 10:00-11:00 am

1. **Course Overview**

In this course we will study the basic role of fuel in reactor operation and understand how the fuel impacts heat generation and transport to the coolant. The course will begin with an overview of different fuels and the fabrication processes required to construct nuclear fuel. We will also study various fuel types and geometries, with a focus on light water reactor fuel and cladding. We will then study changes in the fuel and cladding material that degrade the performance of the fuel. Finally, student will apply knowledge gained to conduct fuel performance simulations.

1. **Learning Outcomes**

By the end of this course, the student should be able to:

1. Understand the basics of fuel fabrication
2. Calculate the rate at which heat is transported to the coolant from the fuel
3. List the most important microstructural changes that take place in the fuel and cladding and how they impact fuel performance
4. Use an existing fuel performance code
5. **Pre- or Co-Requisites**

NE 201

1. **Required Text(s)**

None.

Supplemental texts:

Light Water Reactor Materials, Vol. 1 Fundamentals, D. Olander and A. Motta

Nuclear Fuel Elements, B. Frost

Fundamentals of Radiation Materials Science, G. Was

1. **Course Requirements**

Homework: 20%

Examinations: Exam 1: 15 %; Exam 2: 15%, Exam 3: 15 %

Projects: Written report: 10 %, Final Project: 25 %

1. **Topical Outline: 25 Lectures. 3 classes for exams**.
   1. Introduction and Overview – 1

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* 1. Fuel types – 1
  2. Heat generation, Reactor systems – 1
  3. Fuel fabrication – 1
  4. Heat transport – 3

-------- Exam 1

* 1. Mechanical behavior – 3
  2. Materials issues in the fuel – 3

-------- Exam 2

* 1. Materials issues in the fuel – 2
  2. Materials issues in the clad – 4

-------- Exam 3

* 1. Used fuel disposition – 2

-------- Project 1

* 1. Overview of fuel performance codes – 1
  2. Utilization of fuel performance codes – 2

-------- Final Project