Three open PhD Positions:

**Position 1: Stress Corrosion Cracking behavior of structural alloys for nuclear reactor applications:**

The PhD student will work on the investigation of stress corrosion mechanisms in stainless steels using autoclaves simulating Light Water Reactor corrosion environment followed by characterization of the tested samples using materials characterization tools available at the Analytical Instrumentation Facility on Campus (using electron microscopy and XRD). Samples tested at the university will also be characterized through XRay tomography at the synchrotron. The overall goal is to investigate the stress corrosion cracking behavior of stainless steels used in reactor core. The autoclaves are available on campus in Dr Kaoumi’s labs.

**Position 2: Radiation damage in Ferritic/Martensitic Steels**

Advanced steels are considered as possible cladding or structural materials for the next generation of fission nuclear reactors and for fusion reactor. They are expected to achieve high creep resistance and be resistant to radiation swelling. Since these alloys derive most of their properties from the microstructure (e.g. precipitates etc), a detailed characterization of the microstructure and its stability under irradiation must be assessed. Ion irradiation is a useful technique for that matter as it does not induce radioactivity in the samples and it can be coupled (or not) with TEM. When coupled with TEM, the microstructure evolution in advanced steels can be followed at various temperatures in-situ in the TEM in-situ as ion irradiation proceeds. The irradiation-induced defect formation and evolution, and the stability of as-fabricated microstructure (i.e. dislocation networks) can be characterized. The PhD students will characterize the radiation damage in a F/M candidate steel with particular attention to dislocation loop formation and characterization, irradiation induced/enhanced precipitation (particularly G phase), radiation induced chemical segregation, and void formation. Bothe in-situ and ex-situ characterization will be done. The in-situ experiments will be done at national laboratory facilities, while most of the characterization will be done on campus at NCSU.

**Position 3: Mechanical Behavior of Advanced Stainless Steel for Nuclear Applications**

This project is using mechanistic methods for predicting tensile behavior of the alloy by ways of accelerated tests (at different strain rates and different temperatures) coupled with both in-situ and ex-situ microstructural characterization techniques. *In-situ* X-ray synchrotron (XRD) experiments will be conducted at the Advanced Photon Source (APS), along with *in-situ* straining TEM experiments. The XRD experiments will monitor phase transformations such as dissolution/re-precipitation of precipitates, and determine lattice parameters and peak broadening (for each phase) to evaluate intra-phase chemical composition, strain and average dislocation density contents. In addition, imaging will be used to evaluate microstructural features on the micron-level. The *in-situ* straining TEM experiments will be done to observe and characterize the dislocation dynamics.

**For further information, contact Prof Djamel Kaoumi at:** dkaoumi@ncsu.edu

Further info on the Nuclear Engineering program at NCSU (currently top 5 in the USA according to Newsweek national ranking) can be found at: https://www.ne.ncsu.edu/
For more information on the application process, follow the following links: 
https://www.ne.ncsu.edu/admission/ and  https://www.ncsu.edu/grad/applygrad.htm

Info on the NCSU Analytical Facility to be used in the projects can be found here: 
http://www.aif.ncsu.edu/

Full tuition support and Stipend are available.