

Title: Irradiation creep induced nano-/microstructure and property changes in nuclear graphite

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Sponsor: NNL

Description: Nuclear graphite has been employed as a moderator and structural components in more than 100 nuclear reactors worldwide and they are also projected to use in new Generation IV high-temperature reactors (HTRs). Irradiation-induced creep, among one of the three most important properties of graphite under irradiation, has the least amount of experimental data due to its extremely complex and time-consuming requirements for irradiation tests. So far there are only irradiation creep data on three types of graphite grades: German ATR-2E (up to $200 \times 10^{20} \text{ n} \cdot \text{cm}^2$), UK PGA and UK Gilsocarbon (up to $60 \times 10^{20} \text{ n} \cdot \text{cm}^2$). In this project, the PhD student will have access to the precious neutron irradiated crept Gilsocarbon graphite samples (irradiated in the 5-year ACCENT project and have extensive bulk PIE examination data available) to understand the irradiation creep-induced micro-/nano-structural changes before turnaround, to support the use of new graphites in HTRs internationally.

The PhD student will work closely with a Postdoc and another PhD student funded by NNL for a quick start of the project. This project is primarily experimental-based but the PhD student will have access to the NNL polycrystalline model to validate the measured results. Large-scale experiments using synchrotron diffraction and tomography at national labs (e.g., the UK Rutherford Appleton Laboratory and the US Lawrence Berkeley National Laboratory) are essential for this PhD. Candidates with dedication and passion for nuclear materials are of interest.