A Compact Multimode Detector for the Decommissioning of Irradiated Graphite

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The decommissioning of aging nuclear reactors and future Gen-IV reactors is a global challenge. The processing and disposal of radioactive material from these reactors is a massive endeavour with far reaching environmental and economic implications. The classification and characterisation of these materials is vital not only for reducing the environmental impact of long-lived radionuclides but also in processing them in a fiscally responsible way. One material of particular interest is graphite used in the construction of aging Magnox and AGR reactors. The long-lived radionuclides present in irradiated graphite, particularly and C-14 and Cl-36 present unique issues in their characterisation, processing, and disposal. A novel scintillation detector for this purpose was developed and tested in a series of experiments at Atomfa Trawsfynydd, a twin Magnox reactor site undergoing decommissioning works in North Wales. The prototype detectors were deployed in fuel channels from the reactor charge face, and a radiation survey was conducted at a series of fixed points throughout the channel. In this presentation, the properties of the prototype detectors are examined, particularly their efficiency, noise characteristics, and gamma sensitivity. The results from the experiment are presented and evaluated in comparison to a trepanning study which was conducted in July 2022. Preliminary analysis demonstrates that the detector system is capable of measuring beta activity as a function of depth inside the fuel channel and provide a pulse height spectrum at each position.