

# 778<sup>th</sup> ASRC Seminar

**Date:** February 3 (Mon), 13:30~14:30

**Location:** 2nd floor lobby, ASRC bldg.

**Speaker:** Prof. Ian Farnan (University of Cambridge, UK)

**Title:** The application of radiological nuclear magnetic resonance to the analysis of fuel debris and its interaction with water

## **Abstract:**

The molten core of a light water reactor fueled by zirconium clad  $\text{UO}_2$  fuel will consist of urania-zirconia solid solution ( $\text{U}_{1-x}\text{Zr}_x\text{O}_2$ ). Subsequent interaction with concrete creates a Molten Core Concrete Interaction product (MCCI) that is dominated by crystalline and amorphous phases of predominantly U-Si-Zr oxides. The development of protocols to carry out high-resolution nuclear magnetic resonance (magic-angle spinning) with highly radioactive samples has meant that the ability to characterise the presence and abundance of these phases is greatly enhanced. Indeed, the evolution of amorphisation as a function of alpha dose has been documented and analysed to determine the number of permanently displaced atoms per alpha decay in the (Zr/Pu/U) $\text{SiO}_4$  system using this technique. This approach will be discussed together with a method of forensically analysing the secondary mineralisation of debris through interaction with isotopically doped  $^{17}\text{O}$  water and the direct observation of uranium minerals such as the peroxide mineral, studtite, potentially created by alpha radiolysis at the debris surface.

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