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Measurement of fast neutron removal cross sections for the elemental analysis of concrete

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In nuclear power plants, concrete structures are exposed to high stresses, prolonged high temperatures, moisture and high levels of neutron and gamma-ray radiation. These conditions often cause the concrete to degrade and change in composition over time, particularly with respect to water content [1]. The shielding properties, and subsequent elemental composition, of existing concrete need to be non-destructively determined to ensure compliance with the nuclear regulations.
Previous work at the University of Cape Town has successfully demonstrated the use of fast neutron transmission spectroscopy to determine the composition of a concrete sample with respect to the base ingredients [2], but there are many instances where a more generalised approach is required [3]. Sand is one of the main components of any concrete and is comprised of variable proportions of silicon dioxide (SiO2) and calcium carbonate (CaCO3). In this work we present the results of neutron transmission measurements made with a collimated 241Am-9Be radioisotopic source, incident on samples of sand, SiO2 and CaCO3, and measured with an EJ301 organic liquid scintillator. Spectrum unfolding was used to determine the energy dependent effective removal cross sections for these samples. Future work will include measurements of elemental removal cross sections for carbon and silicon which will be used to infer the elemental composition of sand, and eventually concrete.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

Hons

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