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Analysis of bulk materials using fast neutron transmission analysis

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The non-destructive elemental analysis of materials is of interest to many industries, and fast neutron based techniques are of particular interest due to their sensitivity to low mass elements such as H, C and O. Neutron interactions are strongly energy dependent, and produce a variety of characteristic radiation signatures such as prompt and delayed gamma rays, or transmitted and scattered neutrons. Exposing a sample to a field of neutrons, and measuring the subsequent radiation signatures can be used to determine the sample composition. Examples of established neutron based techniques include delayed gamma ray neutron activation analysis (DGNAA), prompt gamma ray neutron activation analysis (PGNAA), fast neutron scattering analysis (FNSA) and fast neutron transmission analysis (FNTA).

The n-lab is a fast neutron laboratory at the University of Cape Town, and has been previously been deployed in the analysis of bulk samples using fast neutrons. Presented in this work are the results from recent FNTA measurements of 14.1 MeV neutrons incident on graphite (C) and high-density polyethylene (C_2H_4). Transmitted neutron energy spectra were unfolded from pulse height spectra measured with an EJ301 organic liquid scintillator for a range of sample dimensions. From the unfolded neutron energy spectra, the elemental effective removal cross sections for carbon and hydrogen were determined for 14.1 MeV neutrons, and compared to results obtained from Monte Carlo simulations.

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

Yes

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

PhD

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