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Material characterisation through neutron resonance absorption spectroscopy: advances in 2D quantitative isotopic mapping at the ISIS neutron and muon source

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We present novel advances in the implementation of Neutron Resonance Transmission Imaging (NRTI), a non-destructive 2D quantitative elemental analysis technique, performed at the Italian Neutron Experimental Station (INES) beamline operating at the ISIS neutron and muon source, UK.

Neutron spallation sources have high epithermal neutron fluxes, which is a profitable energy range for elemental and isotopic material characterisation thanks to the presence of intense resonance structures in the neutron-induced reaction cross-sections. The NRTI technique is based on the absorption in the sample of incident epithermal neutrons whose energy correspond to the one of absorption resonances, resulting in a transmitted neutron beam containing dips univocally related to the elemental composition. With a position sensitive neutron detector it is therefore possible to obtain 2D radiographies of the sample. However, in contrast with standard neutron radiography, through NRTI it is possible to obtain the distribution of elements and isotopes by selecting a resonance of interest, enhancing the contrast between elements with similar neutron attenuation coefficients. This striking features of NRTI make it suitable for the characterization of inhomogeneous samples, in particular but not limited to Cultural Heritage studies.

Potential applications of NRTI will be presented with particular examples of archaeological sample characterisations.

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