

NEUTRON SCATTERING ANALYSES OF CULTURAL HERITAGE OBJECTS

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Neutron scattering is a vital research and analysis technique for exploring the structure and dynamics of materials and molecules. It provides unique and complementary information to that available from other diagnostic techniques. The main advantage of neutron-based analytical methods is that compositional and structural information can be obtained on the intact object without cutting out a sample of the material. In the past few years, increasing numbers of cultural heritage materials characterisation projects using neutron diffraction have been carried out at the pulsed neutron spallation source ISIS, UK. Neutron diffraction is used for quantitative analysis of metal, mineral, and intermetallic compounds present in a sample. In metals, residual strains, microstrains, and grain orientations can be analysed giving evidence of manufacturing techniques like casting, hammering, and annealing. The structure data are evaluated to obtain estimates of chemical concentrations. For instance, in steel, the cementite content can be analysed by TOF-ND and then used to calculate the bulk chemical composition in terms of weight percent of carbon. Lead added to copper or bronze does not go into solution in the copper and can be directly and accurately determined. The possibility of collecting structural data non-destructively from many points on one and the same object is of advantage for many cultural heritage studies especially if neutron scattering is combined with other non-destructive techniques such as X-ray or neutron imaging.

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