

Neutron diffraction analyses of intact museum

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Neutron diffraction as an archaeometric technique has a particular strong case if any material sampling such as cutting or coring is out of question for intact and unique archaeological artifacts and museum objects. Being both a phase and structure sensitive technique, information about the phase content, the microstructure, the bulk texture, and internal stresses can be non-destructively obtained. The knowledge of the variation of these material properties over different parts of big objects is important for the understanding of ancient production methods. The determination of the mineral phase abundance in ceramics, for example, may provide information on firing conditions such as firing temperatures. Microstructural analyses of metal objects, such as ancient tools, weapons or coins, may hint to specific manufacturing steps like plastic deformation processes or thermal treatments. A texture analysis provides pole figures that may be regarded as fingerprints of the making history. In case the historic production methods are known, the texture information may help to distinguish genuine from fake objects.

Here we report on two recent archaeometric neutron diffraction studies on the time-of-flight diffractometer ROTAX at ISIS at the Rutherford Appleton Laboratory, UK: quantitative phase analysis of 18th century Böttger stoneware from the State Art Collections Dresden and texture analysis of 16th century silver coins from the Kunsthistorisches Museum Wien. Böttger stoneware represents a unique technological development and is characterised by a particular hardness which makes it suitable for surface polishing. The diffraction analyses aimed at distinguishing Böttger objects from other types of red stoneware from China (Yixing), Holland (Ary de Milde) and Plaue in Germany on the basis of the mineral phase content. Another neutron application concerns the texture analysis of silver/copper Taler coins aiming at identifying different 16th century minting techniques in order to distinguish between genuine and fake coins.