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Neutron Computed Tomography as a Basis for Concepts in Preserving Wooden Works of Art

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Since any wooden object is prone to biological degradation some artworks were treated with carbolineum as a preservation agent like railway sleepers. However, this substance reappeared with time on the surface through the painting layers. This not only had an impact on the aesthetics and the stability of the coatings but also exhibited a release of a carcinogenic pollutant into the environment. This made new concepts for preservation measures necessary for both, extracting the pollutant carbolineum and novel protective measures.

An essential prerequisite to remove the impregnation now undesired due to its noxious nature is the knowledge of its distribution inside of the object. The method of choice for this purpose is computed tomography (CT). However, it has to be expected that the impregnant consisting of a carbon hydrogen compounds might be diffusely distributed within a matrix composed of the same elements. Therefore, a radiological method is required which is sensitive to density contrasts of carbon and hydrogen. This makes neutron CT the method of choice. The size of the objects to be interrogated makes it necessary to apply fast neutrons, as they are available at the NECTAR facility of the Heinz Maier-Leibnitz Forschungsreaktor of the Technische Universität München (fission neutrons, 1.8 MeV mean energy). Several steps in image processing have been applied and will be discussed as well as the method of CT reconstruction with parallel beam geometry. Wooden sculptures from an epithaph in the St. Laurentzius Church in Tönning (Holstein, Germany) showing the problems as described above have successfully investigated by neutron CT. Densities have been distributed heterogeneously with high concentrations underneath the surface. However, the nature of these dense areas remains to be elucidated.

Primary author: Dr OSTERLOH, Kurt (BAM Federal Institute for Materials Research and Testing)

Co-authors: Dr NUSSER, Amelie (Rathgen-Forschungslabor, Staatliche Museen zu Berlin); Mr SCHWABE, Andreas (Rathgen-Forschungslabor, Staatliche Museen zu Berlin); Dr KOLKOORIE, Sanjeevareddy (BAM Federal Institute for Materials Research and Testing); Dr BÜCHERL, Thomas (TU München)

Presenter: Dr OSTERLOH, Kurt (BAM Federal Institute for Materials Research and Testing)

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