**Special cases of application of neutron tomography to research of cultural heritage objects**

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Using the method of neutron radiography, due to the varying degree of attenuation of the intensity of the neutron beam when passing through materials of different chemical composition, density, and thickness, it is possible to obtain information about the internal structure of the studied materials with spatial resolution at the micron level. Neutron radiography gives a two-dimensional projection of the object; to obtain a three-dimensional image, the tomography method is used, where a volumetric reconstruction of the internal structure of the object under study is performed from a set of radiographic projections obtained at different angular positions of the sample relative to the beam direction. The nature of the interaction of neutrons with matter and their significant depth of penetration into the thickness of the objects under study give important advantages to neutron non-destructive research methods compared to X-ray techniques, which has caused the growing interest of the world scientific community in their application in a variety of fields. Currently, the method of neutron radiography and tomography, as a representative of the family of non-destructive testing methods, is widely used in scientific applied research of technological and engineering objects; in paleontology and geophysics; in the study of the structure of meteorites; and in archaeology.

The Frank Laboratory of Neutron Physics of the Joint Institute for Nuclear Research (Dubna, Russia) has implemented a whole experimental complex of neutron structural diagnostics of materials, which includes specialized facilities for research by neutron radiography and tomography, neutron diffraction, and Raman spectroscopy. The development of neutron tomography methods provides a growing range of applications in various fields of research. It should be noted that the reliability of the obtained structural information, in addition to methodological and instrumental aspects, depends on the reliability of the analysis of three-dimensional neutron tomography data: segmentation procedures, tomography recovery algorithms, and methods of quantitative analysis of internal inhomogeneities. Therefore, the results of studies of archeological materials by neutron tomography with a focus on special techniques and algorithms for analyzing three-dimensional images are presented.

Thus, neutron experiments allowed us to restore the internal structure and geometry of cracks and phase components in the volume of model archaeometry materials. The dependences of such structural features as the length and thickness of cracks and the morphology and orientation of inner components in the volume of archeological materials Recently, algorithms for quantitative analysis of neutron tomography data were also used to study cultural heritage objects. The spatial distribution of pores inside several fragments of ancient cast-iron cauldrons belonging to the medieval Golden Horde period of Volga Bulgaria has been studied. The high neutron penetration into the cast iron material provided sufficient data for a detailed analysis of the reconstructed three-dimensional models. Analysis of neutron tomography 3D data to obtain the size distributions, some morphological characteristics, and orientation of the internal pores in the cast iron fragments can provide not only qualitative but also quantitative structural markers for cast iron objects.