**Study of ceramic jugs from the National Museum of Kazakhstan by neutron tomography**

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One of the important areas of research in the field of cultural heritage conservation, as well as in archeology and history, is research related to determining the degree of degradation of objects: fixing losses, identifying surface and internal defects, studying variations in chemical and phase composition, structural features of an object, modeling development processes corrosion.

Archaeological sites, objects of cultural heritage are of particular value due to their uniqueness and antiquity, so the most justified is the use of modern methods of non-destructive testing for their study. One of such methods of non-destructive testing, which provide sufficiently complete information about the surface and internal structure of the objects under study, are methods of neutron radiography and tomography. Differences in the total neutron absorption cross section for different elements make it possible to visualize the distribution of composition or structure inhomogeneities in the objects and materials under study and obtain their three-dimensional model for further analysis. The method of neutron radiography and tomography is often used to study archaeological objects, especially ceramic artifacts. This is due to the high absorption of X-rays in materials of great thickness and containing heavy elements, which imposes restrictions on the use of X-ray tomography methods for studying such massive objects.

Archaeological finds obtained from Kurgan 3, Kurgan 1, Kurgan 2 are located near Akterek village, Zhambyl district, Almaty region, Kazakhstan. Ceramic vessels belong to the IV century. BC - III century AD.

Neutron tomography studies were carried out at the TITAN facility located on the 1st horizontal channel of the WWR-K research reactor. At the TITAN setup, the neutron beam was formed by a system of collimators with an aperture diameter of 2 cm and a characteristic parameter of 350. The size of the neutron beam at the sample position was 20 × 20 cm2.

Qualitative Raman scattering at room temperature was obtained using a LabRAM Horiba Evolution & Omega Scope spectrometer with an excitation wavelength of 473 nm, which is located at the NNLOT (National Nanotechnology Laboratory of open type), Al-Farabi Kazakh National University, Almaty, Kazakhstan. A set of spectra were obtained from different local points on the surface of the jug. Measurement range from 100 µm x 100 µm x 15 µm. Preliminary identification of the Raman spectra was performed by comparison with reference data from online databases.