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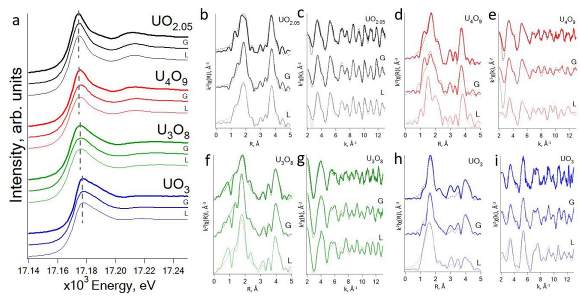

Uranium oxides structural transformation in human body liquids

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Uranium oxide microparticles ingestion or inhalation can become potential sources of internal radiation doses to the humans at accidental or undesirable releases of radioactive materials. It is important to study the absorbed dose and possible biological effect of these microparticles by studying uranium oxides transformations in case of their ingestion or inhalation. It is important that micro- and submicroparticles dissolution kinetics strongly depends on the uranium oxidation state as have been shown for environmental samples: non- or low-oxidized, dioxide, particles are more kinetically stable than oxidized up to U_3O_8. However, the dependence of uranium oxides behavior in human body liquids on the oxidation state is still an open question. In this work for characterization of uranium oxides transformation in simulated gastrointestinal and lung fluids, first the series of uranium oxides are synthetized and characterized by X-ray absorption spectroscopy and Raman spectroscopy. X-ray absorption near-edge structure spectroscopy made it possible to demonstrate small changes in the oxidation state of uranium by the difference in the position of the white line at a resolution better than 1 eV. Extended X-ray absorption fine structure spectroscopy detected the changes in the oxygen sublattice as a result of uranium oxidation for the entire series of oxides. Exposure of uranium oxides to lung fluid caused more dramatic transformation of solid-state oxides surface, according to Raman spectroscopy, than to gastrointestinal fluids due to longer duration of the experiment. Continuance of interaction of uranium oxides with liquids showed up to have more influence on oxide transformation than lower pH in gastrointestinal fluids, according to X-ray absorption spectroscopy (figure 1). The structure of α-UO_3 oxide remained insignificantly changed after the exposure to human body liquids, which is not the case of U_4O_9, U_3O_8 and $UO_{2.05}$. Oxygen sublattice of U_3O_8 and $UO_{2.05}$ after soaking in liquids became more ordered than in the initial oxides. The most significant changes took place in U_4O_9 after exposure to lung liquid. According to EXAFS results, its initial structure undergoes transformations and form different, but more stable structure of non-stochiometric U_4O_{9-y} phase.