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Influence of target thickness on the realease of radioactive atoms

A research program is developed with the installation ALTO (Accélérateur Linéaire et Tandem d'Orsay) at the Institut de Physique Nucléaire in Orsay to provide intense ion beams of new exotic neutron-rich nuclei. For this purpose, optimizing the fission products (PFs) release is a crucial step. Indeed, the first results demonstrated the correlation between the open porosity and the release properties of the uranium carbide (noted UCx, as UC2 and UC are stabilized) target. To go further with this optimization, a study of the milling of uranium oxide powders showed that a multi-ball mill by dry grinding allowed to obtain a nanometer precursor powder. Ultimately, using this powder would provide a nanometric structure of the sintered target and a higher release efficiency by limiting the diffusion path of the FPs through the UCx grains. To test this hypothesis, this powder was used to produce targets following a protocol developed at CERN ISOLDE on lanthanum carbide targets then transposed to UCx targets. The particularity of this protocol is to use nanotubes as carbon source in the carboreduction of UO2 nanopowder into UCx. The structural and microstructural properties of these new targets will be characterized by X-ray diffraction, secondary electron microscopy, He pycnometry and Hg porosimetry. The impact of this microstructure on the fission product release efficiency, determined by spectrometry, will be studied during an irradiation campaign carried out at ALTO.

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