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Morphological and compositional study of 238U thin film targets for nuclear experiments

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The uncertainty on the neutron cross sections strongly depends on the quality and characteristics of the deposited actinide films used as "targets" in the nuclear experiments. Until now, only the activity by alpha-particle counting, the isotopic composition by thermal ionisation mass spectrometry and the diameter of the actinide deposits were measured to determine the mass and areal density of the actinide layer.
In this study a series of 238U deposits, prepared by molecular plating and vacuum deposition on different substrates, were characterized with non-destructive and destructive analysis techniques. The quality of the deposits was investigated by stereo microscopy, autoradiography, high-resolution alpha-particle spectrometry, atomic force microscopy and scanning electron microscopy. The elemental composition was determined by x-ray photoelectron spectroscopy, thermal desorption spectroscopy, depth profiling and inductively coupled plasma mass spectrometry. The latter technique was also applied on the starting U3O8 and converted UF4 powder.
This paper compares the quality and morphology of the deposited 238U films prepared by molecular plating and vacuum deposition on various backings; the elemental composition determined by different characterization techniques and discusses problems in target preparation and characterization.

Primary author: Mrs SIBBENS, Goedele (European Commission - Joint Research Center - Directorate G)

Co-authors: Mr MOENS, André (European Commission - Joint Research Center - Directorate G); Mr VANLEEUW, David (Joint Research Center - European Commission); Dr ZULEGER, Evelyn (European Commission - Joint Research Center - Directorate G); Dr MAROULI, Maria (European Commission - Joint Research Center - Directorate G); Dr ERNSTBERGER, Markus (European Commission - Joint Research Center - Directorate G); Dr WISS, Thierry (European Commission - Joint Research Center - Directorate G); Dr GOUDER, Thomas (European Commission - Joint Research Center - Directorate G)

Presenter: Mrs SIBBENS, Goedele (European Commission - Joint Research Center - Directorate G)

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