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Sputter-coating of Monolithic UMo: A Status Report

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ABSTRACT

In the framework of the joint international efforts to reduce the risk of proliferation by minimizing the use of highly enriched uranium, a new research reactor fuel based on uranium-molybdenum (UMo) alloys is being developed. Monolithic UMo fuel provides the highest Uranium density and up to now has shown promising irradiation behavior. However, fabrication of the fuel plates is not straight- forward, especially if a thickness gradient is needed in the foils.

One approach to monolithic fuel plates containing thickness gradients is to mechanically shape a bare flat foil and later on sputter the interdiffusion barrier onto the foil. As first step, current efforts focus on the PVD (Physical Vapor Deposition) coating of flat foils without gradients. Such sputter-coated mini-foils are supposed to be irradiated in the upcoming EMPIrE experiment to prove the reliability of the underlying manufacturing processes.

The PVD device of TUM is designed for mini-size samples and is a multi-purpose device that allows varying a wide range of parameters relevant for the PVD process. Surrogate foils from stainless steel have already been coated successfully. Using the C2TWP process, plates are manufactured from these foils by AREVA-NP. DU-Mo foils will be treated in the next step.

The device is also designed for other applications like the creation of multi-layer systems containing UMo for ion irradiation and heat treatment experiments. In addition, ion etching is also possible.