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# Challenges and Advancements in PVD coating for nuclear fuel fabrication

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To reduce the uranium enrichment of high-flux research reactor fuels and thereby support the international non-proliferation efforts, new high density fuels are being developed. Monolithic Uranium-Molybdenum alloy (U-Mo) fuel plates are a promising candidate to replace the current disperse $U_2Si_3$ fuels. To avoid unwanted reactions between the U-Mo plates and the aluminum cladding, the application of a diffusion barrier interlayer is necessary.
At the Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II), an adapted PVD based coating process is under development which is capable to coat U-Mo-plates with a 1 – 20µm Zr layer. The processing of such plates involves many unique challenges like radiation protection, nuclear process safety, only little industrial experience with uranium in PVD processes, very strong oxidation affinity and an undesired phase transition of uranium at temperatures higher than 400°C, very high requirements on the layer quality and process repeatability due to the usage in nuclear facilities.
Therefore, FRM II is operating a dedicated uranium metallurgy laboratory which houses four adapted nuclear gloveboxes, providing the ability to study the influence of different technics on the layer quality. This work is focused on several cleaning processes such as chemical-, vacuum- and plasma-cleaning to provide an ideal surface prior to coating as well as different sputtering technologies like sputter coating with substrate pre-heating and/or biasing.

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