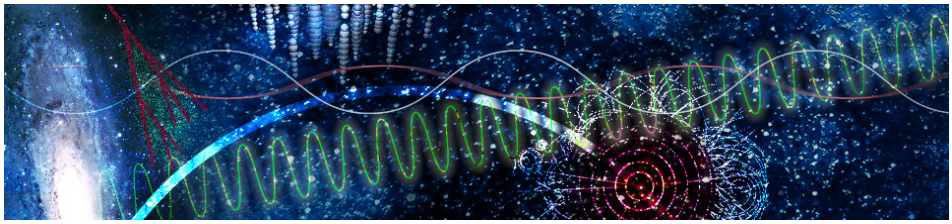

Contribution ID: **27** Type: **Poster**

Actinide and lanthanide thin films for the physics community: the influence of water and carbon dioxide content in solvents on thin film properties

Molecular plating (MP) is an electrochemical deposition method to produce mechanically stable thin films of radioisotopes and the term was coined by Parker and Falk in 1962 [1]. The produced thin films find widespread applications in nuclear physics and chemistry experiments, e.g., as α-particle or recoil ion sources, or as targets for ion beam experiments [2].
To produce thin films via MP, the salt of the respective isotope is dissolved in a small volume of acid, diluted in alcohols, e.g., isopropanol or isobutanol and deposited at a constant current density <1 mA/cm2, which corresponds to high voltages of up to >1000 V. Despite its long use, details of the MP process such as the exact nature of the deposited species are still not fully understood [3]. The deposition yields are only partially reproducible, and the films often suffer from organic residue [4,5] and cracking. To improve our understanding of MP f-element films, experiments were performed, in which the concentration of water and CO2 in the plating solution was systematically changed using the controlled atmosphere inside an argon-filled glovebox. In the experiment series, Tb-nitrate was dissolved in an isobutanol/isopropanol mixture with <50 ppm water content. Observations show that changes in the water and CO2 content affect the deposition yield and the quality of the films quite dramatically. Confirming earlier Raman spectroscopy results [4], our films contain organic residue, oxides, hydroxides, and carbonates [5]. The deposition yield was determined indirectly by performing neutron activation analysis (NAA) of the supernatant solution after the MP at the research reactor TRIGA Mainz. The layer morphology was studied using scanning electron microscopy (SEM). Raman and infrared (IR) spectroscopy were performed to characterize the anionic species in the thin film. The abundance of the different species in the films as a function of the water and CO2 concentration of the solutions was determined.
At the conference the influence of water and CO2 present in the solution on the MP process will be discussed.

Acknowledgments
We appreciate the support of Prof. Dr. Christina Trautmann (GSI, TU Darmstadt), Dr. Ioannis Tzifas (GSI), Dr. Tobias Häger (JGU), the operators of the TRIGA Mainz (JGU) and the TRIGA mechanical workshop (JGU)

References

[1] Parker W., Falk R., Nucl. Instr. And Meth. **16**, 355-357 (1962)
[2] Düllmann, Ch.E., et al. J. Radioanal. Nucl. Chem, **332**, 1505-1514 (2023)
[3] Artes, E., et al. EPJ Web Conf, **285**, 03001 (2023)
[4] Meyer, C.-C., et al. Nucl Instr. Meth. Phys. Res. A, **1028**, 166365 (2022)
[5] Vascon, A., et al. Nucl. Instr. Meth. Phys. Res. A, **696**, 163-175 (2012)

Author: ARTES, Ernst (JGU Mainz, HIM, GSI Darmstadt)

Co-authors: Ms CAVALLO, Primiana (Johannes Gutenberg-Universität Mainz); Prof. DÜLLMANN, Christoph E. (JGU Mainz, HIM, GSI Darmstadt); Mr MEYER, Carl-Christian (JGU Mainz, HIM); Dr RENISCH, Dennis (JGU Mainz, HIM); Mrs SCHAFFNER, Evgenia (Johannes Gutenberg-Universität Mainz)

Presenter: ARTES, Ernst (JGU Mainz, HIM, GSI Darmstadt)

Session Classification: Poster Session