

MLL-KOLLOQUIUM

Donnerstag, 21.06.2018, 16¹⁵ Uhr

Hörsaal der LMU in Garching, Am Coulombwall 1
Treffen zum gemeinsamen Kaffee 16 Uhr

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The Development of a new Nuclear Fuel for FRM II using Heavy Ions

For more than 10 years, swift heavy ions have been applied in the development of uranium-molybdenum (UMo) based fuels for High Performance Research Reactors at the Technische Universität München. These fuels are developed in the framework of the international efforts to minimize the use of highly enriched Uranium in the civil nuclear cycle. Since then, the technique has been advanced from qualitative analysis to quantitative prediction. Therefore, irradiation with heavy ions has become a tool used to quickly reproduce and simulate certain effects of in-pile irradiation tests while avoiding the complexity of handling highly radioactive samples. Additionally, fission gas implantation has been utilized, thus opening a further range of applications.

Several heavy ion irradiation experiments using Iodine-127 ions with energies of 80 MeV have been carried out to understand the behavior of the UMo fuels, especially the development of an interdiffusion layer between the fissionable UMo and the surrounding Al matrix; and to test countermeasures, such as the application of diffusion barriers. Iodine-127 was chosen for these experiments because of its ability to serve as a representative fission product. These experiments have correctly predicted the efficacy of several coating materials, as well as their interaction with surrounding matrix and fuel materials. Moreover, krypton ions implanted on a UMo/Al sample previously irradiated with I-127 led to similar gas bubble growth as observed in-pile. Overall, the experiments very well demonstrate the applicability of the approach for qualitative, and even quantitative, experiments, thus underlining the reliability of heavy ion irradiations to simulate in-pile irradiation effects.

This talk will give an overview of the efforts of FRM II to develop and fabricate the new fuel, with a focus on the application of heavy ions at the MLL.

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