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Heavy Ion Irradiation of Nuclear Reactor Fuel

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For developing new generations of nuclear fuels, in-pile experiments are required. However considering their price and the delay (a few years) between their design and their analysis, each technological solution can not be tested in nuclear fuel reactors. For that purpose, alternative strategies have to be defined, with the view to identify the best candidate to test in-pile.
This talk will be focused on the interest of heavy ion irradiation for the selection of low enriched 235U nuclear fuels.
To fulfill the requirements of international non-proliferation treaty, high density UMo alloys appear as the only appropriated fuel material especially for the most powerful research reactors cores (material testing reactors, neutron sources).
UMo fuel elements usually consist of fissile particles dispersed in an Al matrix. However their in-pile behavior is currently not satisfactory because of the growth of a large interaction layer at UMo/Al interfaces under irradiation.
Heavy ion irradiations with 80MeV 127I ions have been successfully used to simulate the damages caused by the fission products at the UMo/Al interface. The growth of an interaction layer has been reproduced thanks to this out-of-pile methodology. This allows to select remedies (silicon addition to the aluminum matrix, UMo particle coating,...) for the growth of this interaction layer.

This work has been performed in collaboration with FRMII (Munich, Germany) at the MLL tandem accelerator.

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