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# First assessment of a digestion method applied to recover plutonium from refractory residues after dissolving spent SFR MOX fuel in nitric acid

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In the scope of fast reactor spent fuel recycling, head-end research and development are performed at the Atalante facility in Marcoule. Considering the initial plutonium content, quantitative plutonium recovery is one of the main objectives for the dissolution process. In addition, the quantities of undissolved residue increase with the burn up and can impact the waste conditioning downstream.
A silver (II) oxidizing digestion step was studied to assess its application to the treatment of undissolved residues containing eventually some plutonium. This process was first optimised on dioxide plutonium powders, and then tested on irradiated LWR MOX fuel residues.
More recently it was applied to the solid residue obtained after dissolving in nitric media a MOX fuel irradiated in the Phenix Sodium Fast Reactor (SFR). In light of past experimentations and in order to obtain new basic data, not the whole spin was dissolved but only separate sections linked to known local burn-ups (BU). The first objective was to better correlate the quantity/composition of the dissolution residues with the local BU and Pu content of the initial irradiated material. Then the digestion step was applied on each dissolution residue obtained from each fuel pin part (bottom, medium i.e. full-flux zone, upper) with a view to evaluating the complementary Pu recovery, studying key parameters and characterising secondary residues.
The digestion step permitted to recover up to 99% of residual plutonium with some slight differences depending on the position of the pin part the dissolution residue was obtained from. Oxidation conditions, local burn-up and chemical composition were found to be influential. Quantity of residues after digestion was significantly reduced thanks to this digestion treatment. The ultimate residues consisted mainly of metallic compound like ruthenium, molybdenum, rhodium or palladium.

Keywords: recycling, residues, digestion, plutonium, waste.

## Country/Int. Organization

CEA, Nuclear Energy Division, RadioChemistry and Processes Deparment, F-30207 Bagnols sur Ceze, France.

**Primary author:** Ms BURAVAND, emilie (CEA MARCOULE)

**Co-author:** Dr REYNIER TRONCHE, NATHALIE (CEA, Nuclear Energy Division, RadioChemistry and Processes Department)

**Presenters:** Dr REYNIER TRONCHE, NATHALIE (CEA, Nuclear Energy Division, RadioChemistry and Processes Department); Ms BURAVAND, emilie (CEA MARCOULE)

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