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## A comprehensive study of the dissolution of spent SFR MOX fuel in boiling nitric acid (the PHENIX NESTOR-3 case)

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Dissolution experiments undertaken on irradiated fuel pins from sodium fast reactors (SFR) date back to the 80s at the French Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA). They were operated in different workshops and laboratories, using different experimental conditions. In order to regain then extend the knowledge on SFR MOX treatment and recycling for 4th generation systems, new dissolution studies were initiated two years ago on an irradiated pin stemming from a PHENIX NESTOR-3 assembly (initial Pu content of 22.5%, burn up of 12.9at%) that was characterized by destructive and non-destructive Post Irradiation Examinations at the CEA-Cadarache.

As previous dissolution experiments were always carried out on a whole irradiated pin (including the lower axial column), the observed dissolution behaviour was always averaged for a given pin, then sometimes difficult to interpret and to correlate to another fuel. It was therefore decided to carry out innovative dissolution studies on perfectly known separate sections of the same fissile pin to better understand its dissolution behaviour. Three dissolution experiments were thus carried out at the CEA-Marcoule on 30 mm long pieces of irradiated materials after shearing three distinct 120 mm chosen sections of a (U,Pu)O<sub>2</sub> fissile NESTOR-3 pin (bottom, medium i.e. full-flux zone, upper).

Dissolutions were carried out in boiling nitric acid (8 M) for 6 hours to produce a feed solution concentrated at about 180 g/L of U+Pu. Pu dissolution yield exceeded 99,8 % but varied with the zone studied, as did the mass of undissolved residues which increases with the local burn up within the pin.

The irradiated cladding, made of stainless steel 15-15Ti, is prone to corrosion in boiling concentrated nitric acid. Partial dissolution of the main constituents (Fe, Ni and Cr) proved to increase along the fissile pin toward the zone where sodium is the hottest during irradiation.

Keywords: dissolution, fast reactor, plutonium, residue

### Country/Int. Organization

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