Management of zirconium rod claddings with the process of electrochemical breakdown

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One of the wastes varieties resulted from reprocessing of irradiated fuel issued from nuclear-power plant are fuel rods claddings remaining in the apparatus after fuel dissolution. The most common technique of used cladding isolation is its cementing and disposal in metallic containers.

In view of the high cost of the cladding material (zirconium), there have been a number of proposals for this material to be recovered and re-used. However, the residual contamination of the claddings following the dissolution of the fuel and the chemical stability of the zirconium militate against any proposal for a recycling process that might be economically justifiable.

There is, however, information to be found in the literature on the synthesis of mineral-like materials based on zirconium. The idea of using zirconium, which is contained in fuel rod claddings and irradiated fuel itself to synthesize compounds that would be suited to long-term storage or final disposal, is conceptually attractive.

The object of this work was to carry out a study on process of fuel rod claddings electrochemical dissolution in nitric acid solutions.

In the authors' opinion an electrochemical dissolution of fuel rods claddings is the most worth-while technique for preparation of zirconium solutions intended for ceramic matrices synthesis.

The dependences of dissolution rate on nitric acid concentration, temperature and electrolyte composition are presented. It is shown that the highest sample dissolution rate was observed in solutions of dilute nitric acid in presence of calcium nitrate at higher temperatures.

The results of sample surface oxide layers analysis and the composition of precipitates, forming in the course of the dissolution, are given.