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Process modeling of in-situ electrochemical partitioning of uranium and plutonium in purex process: benchmark results with uranium reduction

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ABSTRACT

In-situ reduction of plutonium and uranium for the separation of U/Pu is suitable for plutonium-rich fuels such as FBR fuels. The mathematical basis for a computer program **PUSEP** (**P**lutonium **U**ranium **S**olvent **E**xtraction **P**rogram) for the analysis of partitioning cycle of PUREX process involving in-situ electrochemical reduction of uranium and plutonium is described in the present investigation. Model equations have been developed on the basis of the idealized model for mixer settlers incorporating distribution coefficients and redox reactions of the species involved and solved numerically to obtain concentration profiles of components. The validity of the model equations and associated computer program is tested by carrying out experiments in a proto type 20-stage electrolytic ejector mixer-settler operating without diaphragm for the electro reduction of uranium. The stage-wise experimental concentration profiles of U(VI), U(IV) and nitric acid were obtained and compared with the theoretical predictions. A reasonably good agreement is achieved between experimental and predicted concentration profiles.

Keywords: Purex process; Nuclear fuel processing; Modeling and simulation of SX process; Electrochemical partitioning

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