ANION EXCHANGE EQUILIBRIUM OF URANIUM AND SEVERAL OTHER ELEMENTS IN MINERAL ACID SOLUTIONS CONTAINING TETRAFLUOROBORIC ACID

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Volume distribution coefficients $D_v$ were determined for the adsorption of U and several other elements on anion-exchange resin from mixed solutions of tetrafluoroboric acid and nitric acid or hydrochloric acid, and the effect of tetrafluoroboric acid on the adsorption of each element was studied. The addition of tetrafluoroboric acid, in general, slightly decreased the $D_v$ values while Zr was weakly adsorbed in the HBF$_4$-HCl and HBF$_4$-HNO$_3$ solutions and Nb in the HBF$_4$-HNO$_3$ solutions.

INTRODUCTION

Hydrofluoric acid is often added to HNO$_3$ and HCl solutions for the dissolution of refractory materials such as actinide dioxides, Zr and their alloys in the nuclear industry$^{1-5}$, since complete dissolution of those samples are usually difficult using HNO$_3$ or aqua regia alone.
In order to separate the elements of interest in samples dissolved by adding HF, ion-exchange methods with fluoride-containing media have been studied. Adsorption behaviours of various elements in HF, HF-HCl, and HF-HNO₃ have been investigated by Paris, Nelson et al., and Huff. The behaviours differ remarkably for some elements from that present in pure HCl and HNO₃ solutions. Recently, Adachi et al. have studied anion-exchange equilibrium of hard-acid metals using HF-H₃BO₃ media and proposed a new separation method for Ti, Zn, Ni, Ta, Mo, W and U.

The use of HF is inconvenient because of its corrosive effect against analytical glass wares. When HF is necessarily used, the addition of H₃BO₃ as a masking agent of free fluoride ions may convert HF to HBF₄ and protect the glass apparatus against corrosion.

In this study, the distribution coefficients of U and several other elements were determined on anion-exchange resin in HBF₄-HCl and HBF₄-HNO₃ mixed solutions. Possibility is discussed for the anion-exchange separation of U, Pu and some elements to be measured on the analytical samples of spent nuclear fuels treated with HF.

EXPERIMENTAL

Material

A strongly basic anion-exchange resin, MCI GEL CAO8P/Cl⁻-form, 8% of crosslinking, 100-200 mesh/, was used, obtained from the Mitsubishi Chemical Industries Ltd.

Tetrafluoroboric acid, HBF₄/42%, 6.2M, commercial grade/, was used without further purification, which was supplied by Wako Pure Chemical Industries Ltd.