

Pretreatment for Precise Determination of the concentration of Boron and Cadmium in Zirconium by ICP-OES

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Inductively coupled plasma-optical emission spectroscopy (ICP-OES) is one of the powerful instruments to quantify the amount of impurity in metal sample. For example, the concentration of impurity element, which has high neutron cross section, in nuclear-grade zirconium is determined by ICP-OES. However, zirconium is a line-rich element so that it makes difficult to determine the concentration of impurity element (spectral interference). Although matrix matching is a candidate method to the limits above mentioned, memory effect of high contents of zirconium can be problematic. Therefore, pretreatment is necessary to avoid spectral interference and memory effect. Several pretreatments are available including solvent extraction, extraction chromatography, ion-exchange chromatography, and precipitation. Among several conventional methods, solvent extraction is one of representative method in nuclear chemistry and is applied to the selective elimination of zirconium. Specially, zirconium has higher distribution coefficient in tributyl phosphate (TBP) while impurity element like boron and cadmium has lower distribution coefficient. The weakness of solvent extraction was hard to separate boron and cadmium from zirconium and the secondary organic wastes was generated. On the contrary to solvent extraction, precipitation was very simple method when appropriate precipitant for target element was used. Polyoxometalate (POM) can be considered as a good candidate for precipitant because POM itself has anionic properties as well as has much oxygen atom in regard to the oxophilicity of zirconium. Due to the oxophilicity of zirconium, zirconium was selective precipitated even though some zirconium residue existed in solution while boron and cadmium were not precipitated by POM. This result gave the better separation of boron and cadmium than that of solvent extraction.

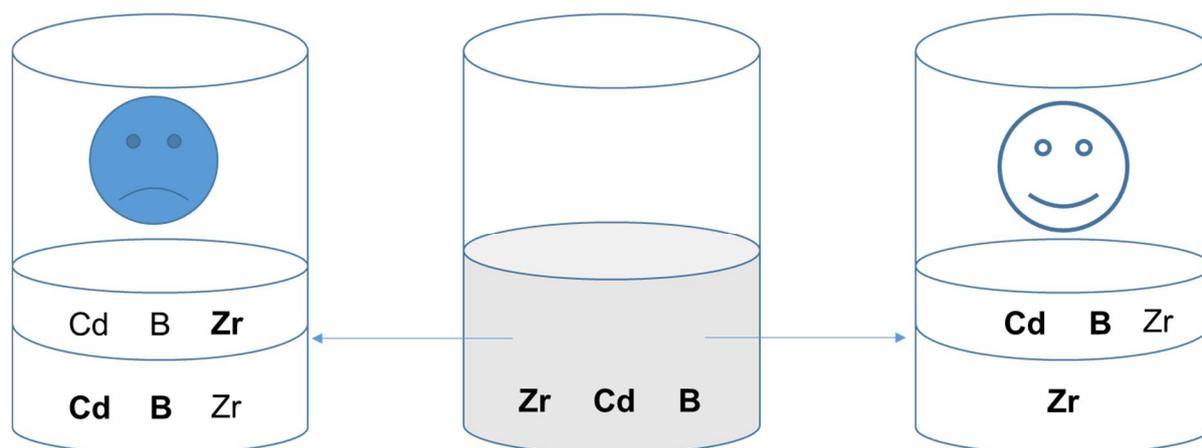


Fig. 4. Scheme for pretreatment of precise determination of boron and cadmium

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