An Evaluation of Digestion Methods for Trace Elements Determination in Bauxite Materials using ICP-MS

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The composition of trace elements in bauxite samples can provide useful information about bauxite deposits. However, the conventional bomb digestion method with HF/HNO_3 results in a significant loss of REEs due to the formation of insoluble AlF_3 precipitates during the digestion procedure of the bauxite samples. In this study, the bauxites digesting capability of the following methods was investigated: the "Mg-addition" bomb digestion method, the NH_4HF_2 open vessel digestion method and the NH4F open vessel digestion method. The "Mg-addition" bomb digestion method can effectively suppress the formation of AlF_3 and simultaneously ensure the complete decomposition of resistant minerals in the bauxite samples. The addition of MgO to the bauxite samples produces (Mg + Ca)/Al ratios ≥ 1. However, adding a large amount of MgO leads to significant blank contamination for some transitional elements (V, Cr, Ni and Zn). The NH_4HF_2 or NH_4F open vessel digestion method can also completely digest the resistant minerals in the bauxite samples in a short period of time (5 hours). Unlike the conventional bomb digestion method with HF/HNO_3, the white precipitates and the semitransparent gels present in the NH_4HF_2 or NH_4F digestion methods can be efficiently dissolved by evaporation with $HClO_4$. Based on these optimized digestion methods, 37 trace elements including REEs in the 10 bauxite reference materials were determined by ICP-MS. New trace elements data for the 10 reference materials are provided.