

Application of Zr/Hf ratio on the determination of hafnium in geochemical samples by HR-ICP-MS

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Hafnium (Hf) content and its change are of important significance in study of geochemistry; however, the determination of hafnium has always been a difficult point in analytical chemistry. In this paper, a new idea was proposed for determination of hafnium in geochemical samples including rocks, soils and stream sediments. Through comparison of two conventional open-type acid digestion methods (HF-HNO₃-HClO₄ method and HF-HNO₃-H₂SO₄ method), it was found that although both of these two methods could not fully digest the zirconium (Zr) and Hf in a sample, the Zr and Hf digestion behaviors were consistent in the experimented 60 geochemical reference materials with different properties, so the determined Zr/Hf ratio dissolved in solution could be used to calculate the Hf content in a sample. In addition, the possible mass spectral interferences during determination of Zr and Hf by high resolution inductively coupled plasma mass spectrometry (HR-ICP-MS) were studied, and the mass spectral interferences of the selected isotopes ⁹⁰Zr and ¹⁷⁸Hf could be neglected; the mass spectral behaviors of ⁹⁰Zr and ¹⁷⁸Hf were also very consistent during determination by HR-ICP-MS. Since the Hf content was calculated using the Zr/Hf ratio, all of the errors of weighing, the accidental errors during operation and the instrument fluctuation in determination could be effectively reduced and even could be eliminated. The standard deviation was lower than 3.0%, and the detection limit was 0.003 µg/g of the method, which was suitable for determining Hf content in geochemical samples.

Keywords: Hafnium; zirconium; Zr/Hf ratio; geochemical samples; HR-ICP-MS.