Analysis of Mixture Samples of Uranium Dioxide and Boron Compounds by using Thermal Neutron Prompt Gamma Activation Analysis

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The internal mono-standard relative method has been used for compositional analysis of prompt gamma activation analysis (PGAA). PGAA is very useful for the analysis of boron elements in various sample matrices, especially in the uranium samples, which attenuates neutron intensity significantly. The concentration ratio of boron is determined relative to the uranium as internal mono-standard. The concentration of uranium is well traceable when the sample was fabricated and also measured by a relative method using certified reference material. The uranium dioxide powder samples were prepared by crushing the fuel pellets and then mixed with the adjuvant compounds to improve the combustion characteristics of the nuclear fuel. The first adjuvant compound is boron compound like boron nitride and hafnium diboride. The second adjuvant is manganese oxide, which is considered to enhance the thermal stability of the boron compounds. The elemental concentrations of the samples were measured by a thermal neutron PGAA facility at the HANARO research reactor and analyzed using a KAERI-PGAA code including a Doppler-broadened boron peak analysis (DBPA) routine for boron analysis.
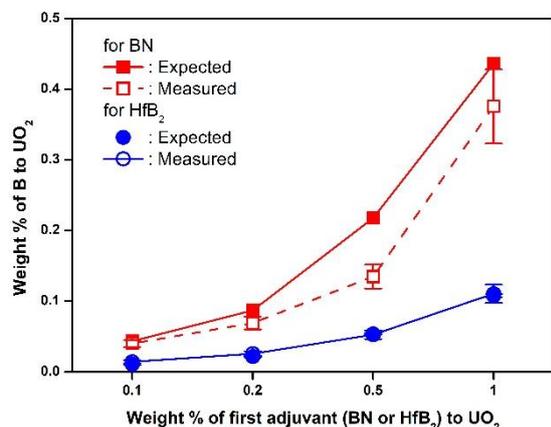
Fig. 1. Comparison of the expected elemental content of boron relative to the UO2 powder.