

Determination of the Content of Hf in Zirconium Alloys with using a Wide Band X-Ray Emission Filter

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The possibilities of a non-destructive method of determination of the content of hafnium in zirconium alloys are studied. The method is based on excitation of the characteristic X-ray emission of the atoms of the object of interest, including the L-series of atom of Hf, by external beam of protons accelerated up to 2 MeV. The excited emission is modified by a wide band X-ray emission filter, which is made from pyrolytic graphite plates and measured by a Si-PIN detector. Optimal conditions for measurement of analytical signal were determined after experimental studying. It was shown that under the selected experimental conditions and the measurement time of 10 minutes, the detection limit of Hf in the zirconium matrix is equal 20 ppm. The ways for improving of the metrological characteristics of the technique in the presence of interfering elements are proposed. The content of hafnium and uniformity of its distribution in the cladding of nuclear fuel rod made from the alloy Zr1% Nb was determined.

Keywords: hafnium, zirconium, characteristic X-ray emission, wave dispersion, energy dispersion
