Novel multilayer for the improved detection of boron by XRF

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For many years synthetic multilayers are used as analyzer crystals for the X-ray fluorescence (XRF) analysis of boron. Because of the low atomic number and the low K-shell energy the fluorescence yield of boron is poor and therefore an improved boron detection both with a higher peak intensity and a better peak-to-background ratio than it has been feasible up to now is desired.

X-ray optical calculations indicate that for boron detection La-B_4C multilayers should be superior to the best currently Mo-B_4C multilayer. We demonstrate that stable multilayer of La-B_4C can be prepared using magnetron sputtering although pure lanthanium strongly oxidizes at the atmosphere. The quality of the multilayers was characterized by X-ray reflection measurements both at Cu-K_α radiation, and at energies between 50 and 250 eV by synchrotron radiation at Hasylab, Desy. A direct comparison to a state-of-the-art Mo-B_4C multilayer was performed by XRF measurements of the boron K_α reflection using samples of B_4C and BPSG (borophosphosilicate glass). The improvements of the peak intensity and the lower limit of detection (LLD) amount to about 64% and 29%, respectively.