

Mg-based multilayer XRF analyzers with two- and three-layers structure design

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Multilayer XRF analyzers are traditionally applied for elemental analysis from Mg to Be since their first introduction in 1980's. Wide variety of material combinations with d-spacing ranging from 1.5nm to 10nm are currently in use. For analysis of a particular element one can find an optimal structure for the best available performance. But there is always demand for improvements. It can just be request for improving quality of existing analyzers, or for lowering number of analyzers in a spectrometer without narrowing number of analyzed elements and loosing much in a performance, or it can be request for an analyzer with new capabilities. For example, in analysis of TiN a Sc-based multilayer is very effective for nitrogen but it does not work for titanium. Crystals such as LiF are used to analyze titanium but they are useless in analysis of nitrogen. To find a single analyzer for TiN material is one of challenging tasks.

To satisfy this particular demand as well as some others we, in this paper propose new multilayer structures working in a wide spectral range and having a superior performance in comparison with existing analyzers. The new structures are Mg-based and may contain three layers in the period. The third layer is introduced for both improving an analyzer performance and for a flexibility to smoothly tune characteristics of an analyzer such as intensity, resolution and peak/background ratio by changing a relative thickness of the layers. Such new capability gives a tool to optimize an analyzer performance depending on application.

Different Mg-based structures were deposited and tested along with traditional multilayer analysers. Essential, up to 100%, improvement in performance was observed for new structures and it was in a good agreement with a simulation.

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