

# Kossel X-ray standing-waves within a Cr/B<sub>4</sub>C/Sc multilayer excited by protons

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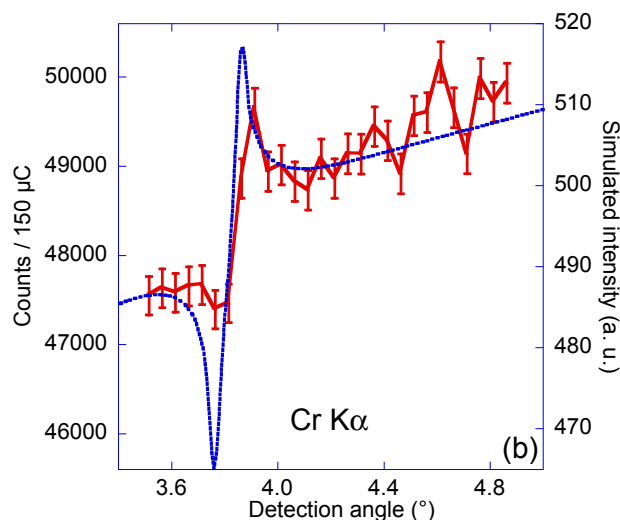
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A characteristic X-ray line emitted from an atom within a periodic structure can be diffracted by the (emitting) structure itself according to the Bragg law. The subsequent Kossel [1] interferences lead to a modulation of the x-ray line intensity as a function of the detection angle in the vicinity of the Bragg angle value [2]. Standing-wave mechanism and Kossel diffraction can be viewed as space reversed processes by virtue of the reciprocity theorem. Kossel interferences have been yet observed using incident X-ray radiation [3-4], electrons [1-2, 5] and ions [6], in crystals [2,5-6] and in periodic multilayers [2-4].

In the present work, we have studied the characteristic Cr and Sc K $\alpha$  emissions produced by a periodic Cr/B<sub>4</sub>C/S multilayer exposed to a beam of 2 MeV-protons. The period of the multilayer is close to 2 nm. The intensity of these two emission lines is measured as function of the grazing exit angle, *i.e.* the angle between the direction of the detector and that of the surface of the multilayer. In the case of the Sc K $\alpha$  emission, in Figure 1 we compare the experimental results to those calculated combining a classical recursive approach to the reciprocity theorem. To our knowledge, it is the first time that ions are used to induce Kossel diffraction in a multilayer. Refined details about the structure of the stack could be obtained, especially the profile and nature of the interfaces.



**Figure 1:** Measured (red) and calculated (blue) intensity of the Sc K $\alpha$  emission as a function of the detection angle.

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