# APPLICATION OF ENERGY-DISPERSIVE DIFFRACTION TO THE ANALYSIS OF HIGHLY INHOMOGENEOUS RESIDUAL STRESS FIELDS IN THIN FILM STRUCTURES

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X-ray stress analysis (XSA) in polycrystalline thin films is usually performed by means of angle-dispersive (AD) diffraction methods with rather low-energy monochromatic X-rays between about 5 and 10 keV. AD thin film strain depth-profiling, however, is a time consuming and demanding procedure, which yields the in-plane residual stress distribution within the film but, as a consequence of the strong X-ray absorption, not in the near interface substrate zone.

Energy-dispersive (ED) diffraction in reflection geometry using high energy synchrotron radiation, on the other hand, has been applied so far only to stress gradient analysis in the near surface zone of mechanically treated bulk materials [1, 2], or as shown recently, in the interfacial substrate zone of coated WC inserts [3]. However, only little work has been done so far to use the information stored in the ED diffraction spectra for analyzing the film inherent stresses [4]. The main reasons therefor are the up to now rather small application of this method, the limited availability of suitable ED (synchrotron) sources and, perhaps, the unfounded idea that high energy diffraction and thin film stress analysis do not match up in an appropriate way.

In the presentation it will be shown that the ED diffraction method is even suitable for evaluating simultaneously steep stress gradients in thin films as well as the stress distribution in the interfacial substrate region beneath. The results which were obtained at the materials science beamline EDDI at BESSY [5] are in excellent agreement with conventional AD-XSA measurements performed in the lab, thus demonstrating that the ED method has the potential to become a powerful tool for fast and reliable thin film stress gradient analysis.

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