Performance of Multilayer Monochromators for Hard X-ray Imaging with Coherent Synchrotron Radiation

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Abstract:

We present a study [1] in which multilayers of different composition (W/Si, Mo/Si, Pd/B_4C), periodicity (from 2.5 to 5.5 nm), and numbers of layers have been characterized. Particularly, we investigated the intrinsic quality (roughness and reflectivity) and the performance (flatness and coherence of the outgoing beam) of the samples as monochromators in synchrotron microradiography. The results indicate that material composition is the dominating factor for the performance. This is important for synchrotron-based hard X-ray imaging methods. In these techniques, multilayer monochromators are popular because of their good tradeoff between spectral bandwidth and photon flux density of the outgoing beam, but sufficient homogeneity and preservation of the coherent properties of the reflected beam are major concerns. The experimental results we collected may help scientists and engineers specify multilayer monochromators, and can contribute to better exploitation of the advantages of multilayer monochromators in microtomography and other full-field imaging techniques.

References:

[1] A. Rack, T. Weitkamp, M. Riotte, D. Grigoriev, T. Rack, L. Helfen, T. Baumbach, R. Dietsch, T. Holz, M. Krämer, F. Siewert, M. Meduna, P. Cloetens, E. Ziegler (accepted to J. Synchrotron Radiat.).

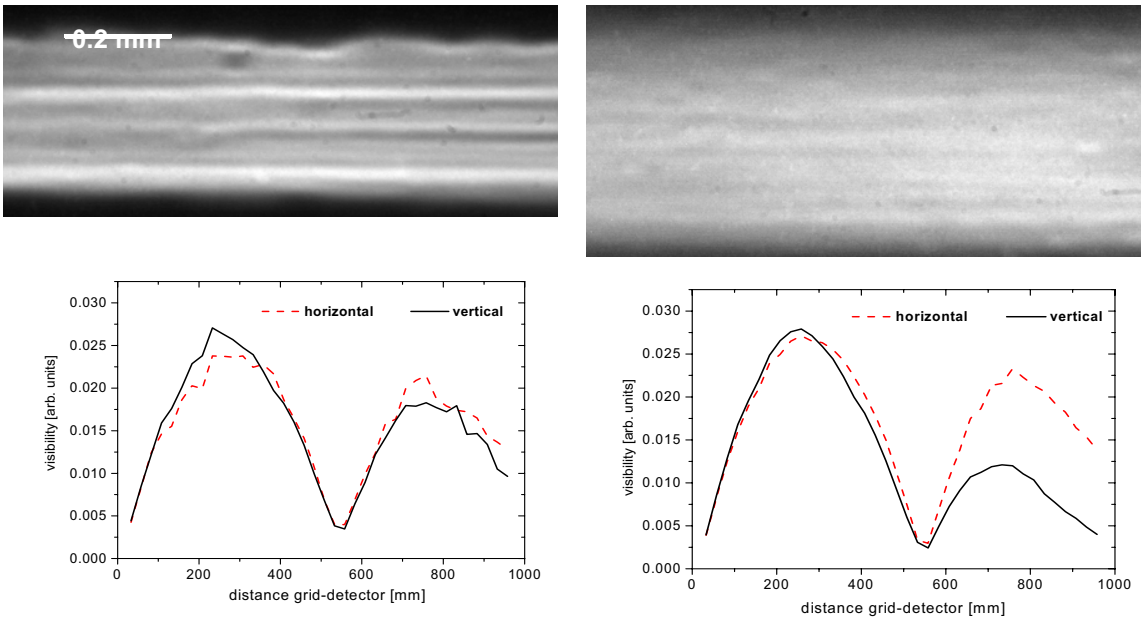

Figure 1: Beam profile after reflection on a Mo/Si (top, left) and on a Pd/B_4C (top, right) multilayer; bottom: coherence measurements (visibility of a phase grating in dependence on its distance to the detector).