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Highly efficient multilayer-coated blazed and laminar gratings for tender X-ray energy range

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Multilayer coating on top of high line density blazed gratings can increase its diffraction efficiency up to one order of magnitude for a selected diffraction order. In combination with multilayer coated pre-mirror in plane grating monochromator (PGM) the total instrument transmission can be increased in hundreds of times. In our developments on multilayer-coated blazed gratings (MLBG) we have reached experimentally efficiency up to 60% [1,2] in tender energy range where single coated grating would demonstrate only few percent. After several successful prototypes the real MLBG were designed and installed in c-PGM at u41-TXM-beamline at BESSY-II [3].

The key factor of high performance MLBG is in correct optimization of both multilayer and grating profile parameters to each other [4]. Our current developments are focused on extension of operating energy range, employing ML coating on laminar profile (MLLG) and tuning the optimization in order to significantly increase grating angular dispersion (i.e. an instrument energy resolution) with minimal losses in the grating efficiency. In our contribution, we are presenting our latest successful experiments with broad energy range MLBG, high efficiency MLLG and MLBG optimized for higher diffraction orders. Together with this, we are going to discuss possibilities to reach highest of possible resolving power with MLBG and challenges connected with that.

[1] A. Sokolov et al., Opt. Express 27(12), 16833 (2019)

[2] F. Senf et al., Optics Express 24(12), 13220 (2016)

[3] S. Werner et al., Small Methods 7(1), 2201382 (2023)

[4] Q. Huang et al., Opt. Express 28, 821 (2020)

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no

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