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Blazed Soft X-Ray Gratings Fabricated by Grey-Tone Electron-Beam Lithography and Thermal Oxidation of Silicon

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Blazed gratings are an essential element for instruments used at free electron laser and synchrotron facilities in soft and tender X-ray ranges. Their application ranges from beamline monochromators and spectrometer analyzers to self-seeding and pulse compression elements. These gratings are commonly made by mechanical ruling, however, the production time of high-quality blazed gratings has become a major bottleneck due to technological challenges in their fabrication and few suppliers only.
In this presentation, we report on a novel method for the production of next-generation X-ray diffraction gratings based on grey-tone electron-beam lithography (EBL) and thermal oxidation of silicon. This new technology gives advantage of high flexibility regarding the grating design, allowing for enhanced optical performance as well as novel optical functionalities. This EBL technique with its high resolution allows for the fabrication of several gratings with different pitches and/or blazed angles on the same substrate.
We will also present the at-wavelength characterization of manufactured blazed gratings. The measurements were done at the Optics beamline at BESSY II. The diffraction efficiency over the soft X-ray energy range, as well as the dispersion of the gratings, was investigated. The results show that the measured gratings match the required surface roughness, high diffraction efficiency, and very low diffuse scattering noise.

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yes

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