High Aspect Ratio Gratings for X-ray Phase Imaging

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Differential phase contrast X-ray imaging (DPCI) has gained a lot of interest in the past years as it bears the potential of radiographic and tomographic imaging of low absorbing material with high impact in medical and materials application. DPCI is based on X-ray grating interferometry and the image quality is strongly dependent on the grating quality. Periodic line and space structures with periods in the micron range are required for the source and absorption grating. In case of energies > 30 keV their height should be larger than 100 µm resulting in aspect ratios of more than 100. We used deep X-ray lithography and gold electroforming (LIGA technology) to fabricate these challenging structures. Gratings with a 2.4 µm period have been electroformed up to 130 µm (Fig. 1), Visibilities of up to 70% for 29 keV and up to 20% for 52 keV have been achieved for monochromatic synchrotron light. Structures with larger periods could be manufactured even up to 250 µm; further increase of the height is possible. In the presentation we will describe the process for grating fabrication including the process variation to bend the gratings for cone beam use (Fig. 2) as well as the results on the grating quality analysis. We will discuss the currently on-going work to further improve the gratings and the steps for their commercialization.

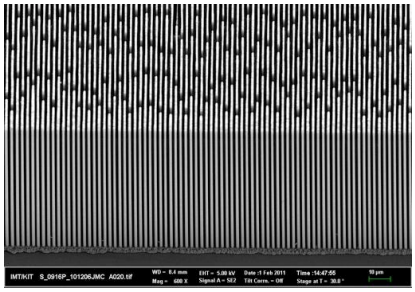

Fig. 1: Grating with a period of 2.4 µm and a height of 130 µm

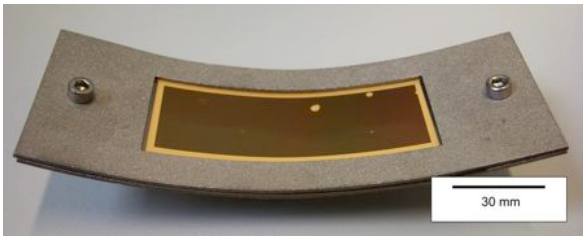

Fig. 2: Bended grating