

Coherent Lithography with Table Top Soft X-ray Lasers: Latest Achievements and Prospects

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Abstract: *We will present the latest results in the development of a Talbot lithography technique utilizing table-top SXR lasers. The main characteristics of the method will be reviewed and a hybrid scheme that combines interferometric lithography with Talbot lithography will be presented. This approach that we named Talbot Interference Lithography allows to overcome resolution limitations typical of the classical Talbot imaging.*

We will describe lithography approaches utilizing a soft X-ray (SXR) tabletop laser emitting at 46.9nm. In particular the talk will focus on a lithographic method based on Talbot imaging. The characteristic of this approach is that it enables the fabrication of periodic nanostructures with arbitrarily complex design. Furthermore, a main advantage is that the lithographic step is by nature “defect free”, allowing for defect free prints from defective lithography masks. Examples of structures fabricated with this method with feature sizes down to 40nm will be presented.

In addition we will describe a hybrid technique combining Talbot lithography and interference lithography that is capable to generate periodic nanostructures with an arbitrary lattice.[1] At a common Talbot plane, two Talbot images generated by coherent SXR laser illumination are superimposed. In this way, an interference pattern with high resolution is modified by a defined Talbot image. One of the advantages of this method is that it enables the printing of arbitrary shaped cells with high resolution drastically relaxing the fabrication constraints of the mask. The hybrid method that combines Talbot lithography and interferometric lithography was named Talbot Interference Lithography (TIL). It can claim the advantages of both lithography methods, allowing the printing of patterns that neither of them can accomplish separately.

In the talk we will present a description of the system, and a detailed modeling of the method. The capability and advantages will be also discussed. Finally experimental results using the tabletop SXR laser will be examined.

[1] W. Li and M.C. Marconi. Optics Express, 23, 20, 25532, (2015).