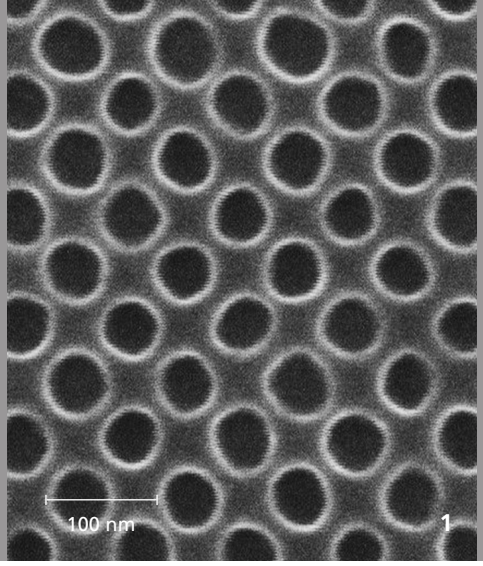
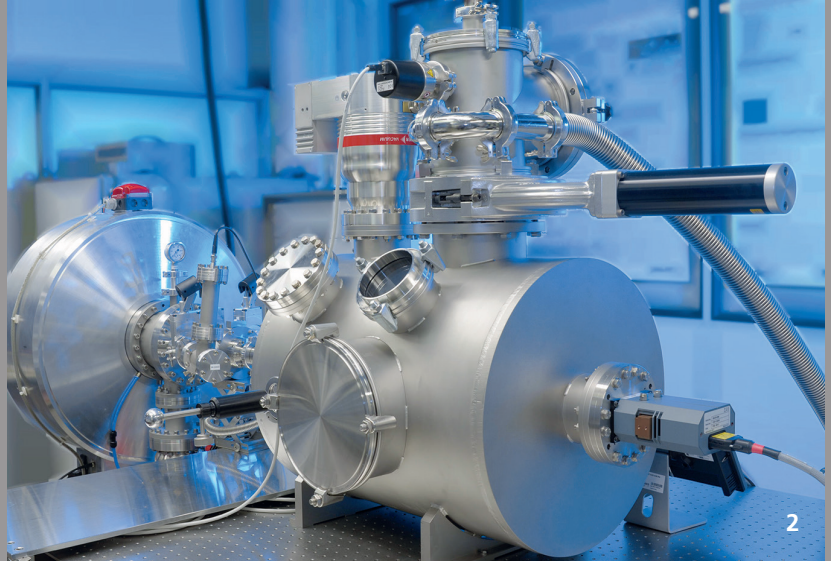


1



2

PLANT FOR NANOSTRUCTURING USING ACHROMATIC TALBOT LITHOGRAPHY

Task

Various applications require nanoscale structures. In order to achieve a sufficiently high throughput, lithographic methods lend themselves to generating such structures. In this project a parallel, large-area exposure of highly efficient transmission masks is used to generate theoretically intensity modulations with a period of 20 nm. The use of the achromatic Talbot effect with short-wave, extreme ultraviolet radiation (EUV) offers further advantages such as mask defect compensation and structural reduction. Thus, when a contrast-rich photoresist is exposed, nanoscale structure arrangements such as line or hole arrays can be produced over a large area within a few minutes.

Method

The developed EUV-laboratory exposure tool consists of the EUV-gas-discharge source, the respective transmission mask and the photoresist to be exposed, which is applied to a wafer. Reproducible exposure conditions are ensured by a precise dose monitor and a sophisticated mask-wafer distance metrology system, which enables the highly accurate positioning of the wafer at a distance of a few micrometers behind the transmission mask. Stationary intensity modulation, which is used for the structuring, results in a distance range of 20 µm. The contrast of the intensity modulation was increased further by means of phase-shift masks to achieve the theoretical resolution limit.

Results

The structuring system developed here makes it possible to produce minimum structure sizes of 35 nm. At present, this is the world record for the interference principle of achromatic Talbot lithography.

Applications

The structuring plant can be used for the production of periodic, nanoscale structural arrangements extending over several square millimeters. In addition, photoresists can be characterized in terms of sensitivity, contrast and resolution.

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1 Exposure result (35 nm, a world record).

2 Exposure station EUV-LET.

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DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01