Nanostructuring of macroscopic areas

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Based upon the pioneering works to explore new phenomena at the nanoscale, the demand for large area nanostructured materials is rapidly increasing. The bottlenecks in these developments are often the required time consuming and sophisticated top-down methods (e.g. electron-beam lithography). Our group addresses these challenges by combining the well established top-down techniques with bottom-up fabrication methods.

Holographic lithography is a convenient way to prepare 1D and 2D, even sinusoidal periodic structures on arbitrary surfaces down to 100 nm line width (*Phys.Stat.Sol. (a)* 202 p.1639–1643 (2005)). Besides, laser ablation using excimer and YAG lasers from 193 nm to 1064 nm wavelength as well as and rapid thermal annealing (RTA) is also available.

Expertiese in the preparation and characterization of **nanoparticles** is also available. These colloidal nanoparticles are used for the preparation of mono-, and multilayered films on different substrates (*Fig. A*, *Langmuir* 22 p.8416–8423 (2006)). The particulate films can be exploited as masks for ion-implantation or for deposition of different materials. The periodically modified, patterned surfaces are prerequisites for the preparation of various periodic **nanostructures** from silicon, such as ordered nanopillars, nanoholes or honeycomb-like structures (*Fig. B*, see *App.Phys.Lett.* 89 063104 (2006) for details.). Further structuring is possible using photolithography, combining nanostructuring with traditional patterning (*Fig. C*).

Wet chemical methods are used for the **growth of ZnO-based nanostructures**. By applying different substrates highly ordered, and well aligned ZnO nanorods (*Fig. D-E*), or nanograss (*Fig. F*) with large surface area can be obtained.

The nanopreparation work is backed up by a wide range of different sophisticated **characterisation and analytical techniques** at our institute.