Glass and III/V (GaSb) surfaces with defined roughness by self-organization through maskless dry-etching

Prof. Dr. Henning Fouckhardt fouckhar@physik.uni-kl.de
Physics department, Kaiserslautern University of Technology, Germany

In 1962 Navez et al. [1] ion-beam-bombarded glass surfaces and observed wave-like structures for flat ion beam incidence and dots/cones for nearly perpendicular incidence as resulting surface morphologies. Typical wave periods and characteristic dot sizes were in the range of some 10 to some 100 nm. As described by Valbusa et al. [2] many groups picked up these investigations with (reactive) ion-beam machines (RIBE) as well as with (reactive) ion etching (RIE). Materials used were not only amorphous glass, but also semiconductors or even metals. – The phenomenon observed and described in those publications is *self-organization* during maskless dry-etching due to two compensating effects, which together stabilize the surface: first a preferred etch erosion at oblique flanks and secondly migration of the eroded particles into the etched depressions. Another phenomenon, which results in cone sizes around 1 µm or more, is *self-masking* especially in the case of heterogeneous glasses like borosilicate glass [3]. Thus a wide range of scatterer sizes and shapes as well as surface roughnesses can be achieved. – This contribution deals with two aspects:

1) the promising attempt to employ the self-organization phenomenon to achieve dense lying quantum dots in GaSb-based samples (see Fig. 1 left),
2) the wide range of possible surface morhologies and topologies on borosilicate glass (see Fig. 1 right) to be employed to realize certain optical scattering characteristics.

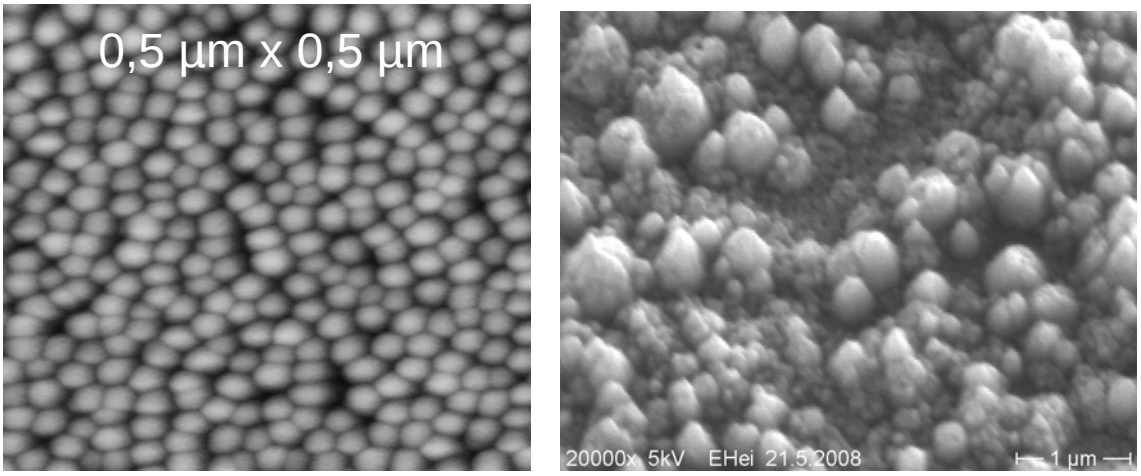

Fig. 1: left: example for rough GaSb surface for realization of dense lying quantum dots; right: example of rough borosilicate glass surface to achieve certain optical scattering characteristics

[1] M. Navez, C. Sella, D. Chaperot. Compt. Rend. J. Phys. Acad. Sci., Paris 254 (1962) 240

[2] U. Valbusa, C. Boragno, F. Biatier de Mongeot: Nanostructuring surfaces by ion sputtering. J. Phys.: Cond. Matter 14 (2002) 8153

[3] H. Fouckhardt, I. Steingoetter, M. Brinkmann, M. Hagemann, H. Zarschizky, L. Zschiedrich: nm-scale surface roughness on glass with specific optical scattering characteristics on demand. Advances in OptoElectronics. article ID 27316 (2007) 7 pages. doi: 10.1155/2007/27316