Controlled deposition versus self-assembling of nanostructures

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We demonstrate the potential of shadow growth to obtain well-defined nanostructures. The resolution of this selective area epitaxy (SAE) technique is limited by partial shadows and surface diffusion. In molecular beam epitaxy diffusion lengths are normally of the order of micrometers, but kinetics are efficiently reduced at low substrate temperatures. Besides LT-growth, nanometer resolution is also accessible in the case of materials with direction dependent diffusion due to their surface reconstruction. We have observed very short diffusion lengths for the growth of II-VI semiconductors (under group VI-rich conditions). This means that for example *magnetic semiconductors* (LT-Mn:III-V; Mn:II-VI) *are ideally suited for in-situ nanostructuring with shadow masks*.

With fixed masks developed from AlGaAs/GaAs layers on GaAs [001]-substrates we have minimized partial shadows and are able now to grow homogeneous nanostructures. New processes have been tailored for the deposition of compound semiconductors, and expand the degrees of freedom of this technique, which are

lateral layer offset, *selective doping*, lateral *composition modification*, *secondary shadowing*, *size-control* (compound enhanced sticking) and the usage of *2D-structured masks.*

In this way precise growth of nanostructures has been achieved without noticeable influence from self-assembling effects. This direct growth control and the independence from interfering diffusion dynamics are a great advantage compared to other in-situ techniques that utilize self-assembling for the formation of nanostructures.

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