Strategies for controlled assembly at the nanoscale

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The bottom–up approach is emerging as a viable alternative for low cost manufacturing of nanostructured materials [1]. It is based on the concept of self–assembly of suitable nanostructures on a substrate. We propose various strategies to control nanostructure assembly (both organic and inorganic) at the nanoscale. Our approaches include:

(i) surface patterning through a nanostencil [2] (i.e. a shadow mask with nanoscale features) and deposition on naturally patterned substrates, which take advantage of long–range reconstructions [3-5].

(ii) we are able to control the size and luminescence properties of semiconductor nanostructures, synthesized by reactive laser ablation [6–8].

(iii) we have developed new experimental tools and comparison with simulations are presented to gain atomic scale insight into the surface processes that govern nucleation, growth and assembly [9, 10].

(iv) by controlling inter-molecular interactions, we demonstrate that it is possible to create specific nanoscale patterns [11-13].

(v) we developed a simple surface modification strategy for biomaterials which enhances biocompatibility [14-17].

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