# Combinatorial investigations of evaporated and sputtered gradient noble metal / polymer /Si multilayers


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Large area nanostructuring of noble metal nanoparticle layers is of high technological and scientific interest. The broad field of application of such layers includes bio-recognition and optocelectronic devices [1]. This is due to the plasmon resonance in noble metal nanoparticles leading to strong absorption bands in the visible light. The plasmon resonance depends strongly on the nanoparticle layer structure and morphology.

Combinatorial studies of single or multidimensional gradient samples allow for high throughput and identical environmental preparation conditions [2]. Hence characterization on multiple length scales ranging from nano- to micrometer is indispensable. In our studies we focussed on single-dimensional gradients prepared by common vacuum deposition techniques like evaporation and sputtering [3,4,5]. Though optical spectra might show similar behaviour the nanostructure of such samples is distinctly different depending on the deposition method [5]. These single-dimensional gradient Au / polymer / Si composite samples allow installing a gradient in nanoparticle morphology while keeping all other parameters like substrate temperature and deposition rate constant. We investigated these novel gradient samples using local techniques (atomic force microscopy, transmission / scanning electron microscopy) and microbeam grazing incidence small-angle x-ray scattering (μGISAXS) at ID13 / ESRF. The latter technique has been proven to be extremely suited as a non-destructive high-throughput method for laterally heterogeneous samples [3]. We compare the results obtained with different deposition methods. In addition we are able to directly compare the results from μGISAXS obtained by direct modelling analysis which renders the 3D morphology of the composite sample with side view obtained by TEM [5].


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