

Atomic force microscopy characterization of nanoparticles on rough surfaces

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Nanoparticle analysis is an important challenge in present nanoscale metrology. Nanoparticles are used in many fields of research and technology and their proper characterization is therefore very important. Besides the fact that there are several general approaches to nanoparticle analysis (optical methods, microscopy), results of them differ mutually very often due to different effects of non-ideal measurement conditions.

Nanoparticle analysis can be performed using scanning probe microscopy methods (namely atomic force microscopy - AFM). If the isolated nanoparticles are deposited on an ideally flat substrate and they are spherical, the size of a nanoparticle can be determined easily from the AFM image by measuring the nanoparticle image height. However, for non-ideal particles and curved substrates many questions arise from the point of particle analysis in AFM image processing software. In this contribution algorithms for non-ideal nanoparticle analysis on rough and curved substrates will be presented. Particle aspect-ratio measurement, agglomerated particles analysis, particle orientation analysis and similar topics will be addressed. Moreover, an analysis of uncertainties due to tip-sample convolution effects on results of statistical particle analysis will be presented.

Examples will be given for nanoparticles prepared using different methods and using different materials (gold, palladium, polystyrene). For all the algorithms presented, an open source application Gwyddion (<http://gwyddion.net>) will be used.