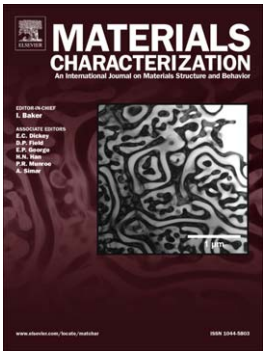

An assessment of errors in sample preparation and data processing for nanoparticle size analyses by AFM

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An assessment of errors in sample preparation and data processing for nanoparticle size analyses by AFM

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Abstract. Accurate measurements of particle size, which are essential for a better understanding of nanoparticle properties, are often influenced by sample preparation and image data treatment. In this work, we discuss the errors associated with different methods of sample preparation and data treatment in AFM size measurements using polystyrene nanoparticles with sizes of 102 ± 3 nm on silicon and mica substrates. Silicon has the advantage over mica of being conductive. The dilution of the polymeric nanoparticle suspension was sufficient to achieve good dispersion on the mica substrate, but not on silicon. Sample preparation on silicon was significantly improved by treating the substrate with glow discharge. The addition of a dispersant can cause errors of approximately 20% if the height of the coating that is formed is not considered in the particle size measurement. Both the software for data treatment and the type of flattening procedure were shown to influence the particle size measurement. Particle size has been significantly influenced by data treatment and the type of flattening procedure. No meaningful effect of the interpolation method on the measurements of the average particle size was observed under the experimental conditions, but the variance was affected. The results also demonstrated that image size and pixel size should be carefully selected to obtain an accurate measurement in a short period of time. The results were compared using Student's t-test at a 99% confidence level.

Introduction

Nanoparticles have unique properties that are directly correlated to their size, shape and size distribution, making it important to be able to measure these features outside and