# Towards a Quantitative Understanding in Electron Tomography - Quantitative Analysis of 3D Nanoparticle Distributions -

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Keywords: electron tomography, SIRT, 3D quantification, nanoparticle, catalysis

State-of-the-art electron tomography is a versatile tool for visualizing morphologies and particle distributions in 3D for a wide range of applications. Some prominent examples come from such diverse areas as catalysis [1], semiconductor materials [1,2], block copolymers [3], polymer composites [4] and biological applications [5].

In addition to improving the resolution in 3D, one of the major aims in (electron) tomography is to move from purely qualitative imaging towards fully quantifiable results. In most cases, an ideal reconstruction of the 3D volume is assumed for the quantification, with noise and the missing wedge posing ‘minor’ limitations for the image segmentation and thus for the quantification. The implicit assumption is that in the absence of noise and with a complete tilt-series, identical materials within a sample should result in identical intensities in the reconstructed volume. However, our recent experimental results on different high-contrast data sets clearly show that this assumption is not valid (Figure 1). The reconstructed intensities are strongly dependent on the feature size and vary by a factor of 25 for the same material within one reconstruction. This effect is present with SIRT and with WBPJ, even though the feature size dependency differs. These experimental findings have been confirmed using simulations assuming perfect projection conditions. These results and their strong implications for particle detection and quantification of any tomographic data will be discussed.

References

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DOI: 10.3217/978-3-85125-062-6-037, 

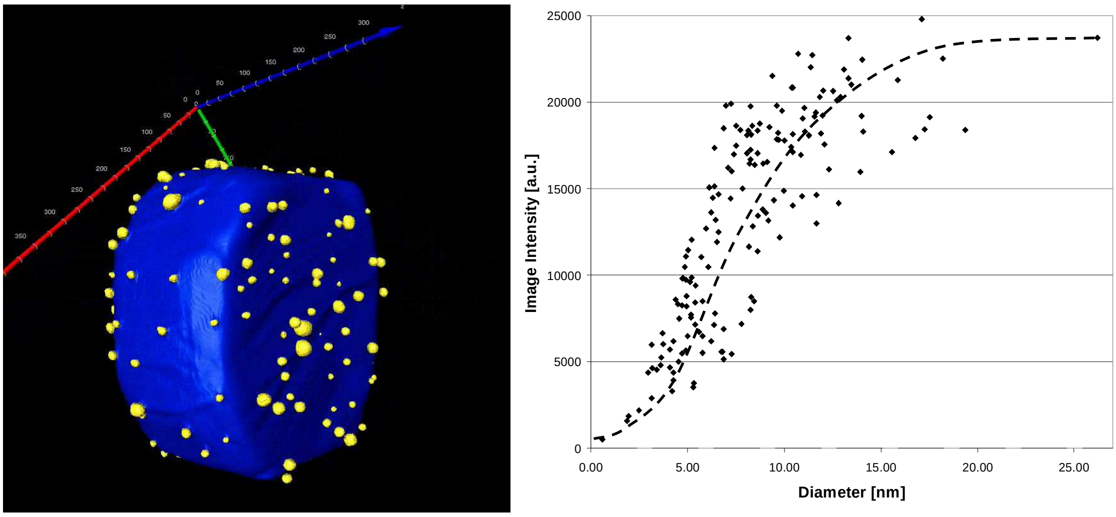


**Figure 1.** Surface rendering of metal catalyst nanoparticles supported on a mesoporous silicate. The quantitative analysis of the reconstructed image intensities reveals a strong feature size dependence.

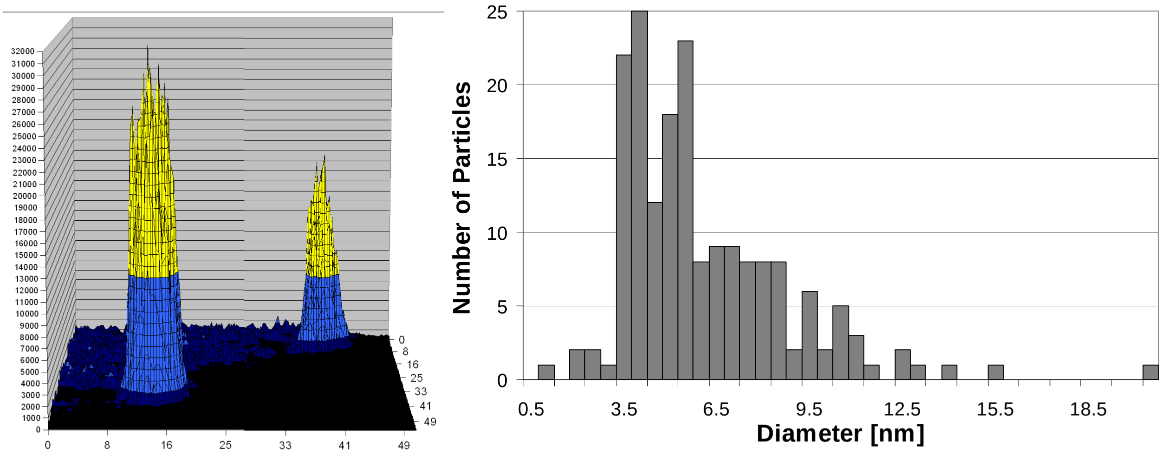


**Figure 2.** Image segmentation performed by local 3D FWHM segmentation with independent threshold for each metal particle results in a reliable particle size distribution measurement, which is only affected by missing wedge effects.


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