

Critical Comparison of Volume Data Obtained by Different Electron Tomography Techniques

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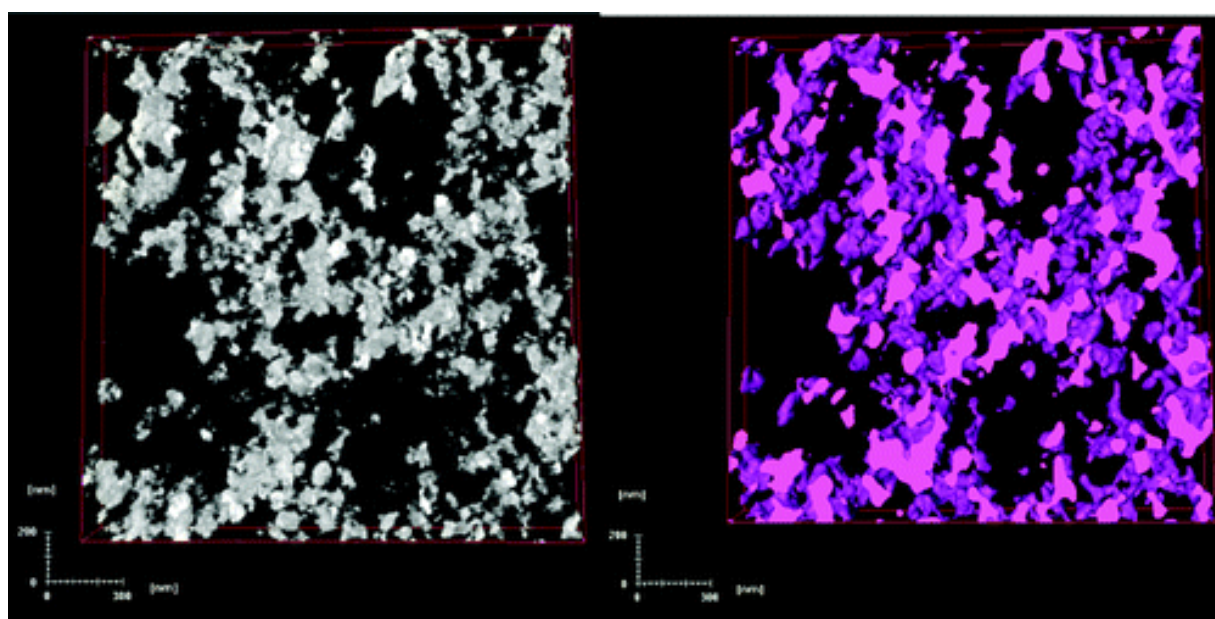
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We have utilized bright field conventional transmission electron microscopy (BF-CTEM) tomography and annular dark field scanning transmission electron microscopy (ADF-STEM) tomography to characterize a well-defined carbon black (CB) filled polymer nanocomposite with known CB volume concentration. For both imaging methods, contrast can be generated between the CB and the surrounding polymer matrix. The obtained volume reconstructions were analyzed and the CB volume concentrations were carefully determined from the reconstructed data. For both imaging modes the measured CB volume concentrations are substantially different: the CB volume concentration measured in BF-CTEM tomograms exceeds by about 40%, whereas the one measured in ADF-STEM tomograms equals to a good approximation the concentration actually used to synthesize the composite. We critically discuss possible reasons for this significant difference in relation to the characteristics of the imaging technique arguing that, at least in the considered case of low electron scattering materials as polymer systems, ADF-STEM tomography provides good contrast between the components and volume data sets most suitable for further reliable quantification of nanofiller concentrations and filler distributions in polymer nanocomposite systems.

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