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**Dark-Field Scanning Transmission Ion Microscopy *via* Direct Detection of Transmitted Helium Ions with a Multichannel Plate** TAYLOR WOEHL, RYAN WHITE, ROBERT KELLER, Material Measurement Laboratory, National Institute of Standards and Technology — A multichannel plate was used as an ion sensitive transmission detector in a commercial helium ion microscope for annular dark-field imaging of nanomaterials, i.e. scanning transmission ion microscopy. In contrast to previous transmission helium ion microscopy approaches that used secondary electron conversion holders, our new approach directly detects transmitted helium ions on an annular detector. Monte Carlo simulations are used to predict detector collection angles at which annular dark-field images with atomic number contrast are obtained. We demonstrate atomic number contrast imaging *via* scanning transmission ion imaging of silica-coated gold nanoparticles and magnetite nanoparticles. While the resolution of this transmission technique is limited by beam broadening in the substrate, we image magnetite nanoparticles with high contrast on a relatively thick silicon nitride substrate. We expect this new approach to annular dark-field scanning transmission ion microscopy will open avenues for more quantitative ion imaging techniques, such as direct mass-thickness determination, and advance fundamental understanding of underlying ion scattering mechanisms leading to image formation.

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