Electron beam damage reduces dopant potentials measured by off-axis electron holography

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The quantitative measurement of dopant distributions in nanoscale semiconductor devices with high spatial resolution is highly challenging. Off-axis electron holography is a powerful technique that can be used to measure dopant potentials in electron-transparent specimens in the transmission electron microscope with nm spatial resolution. It is well known that the magnitudes of dopant potentials measured using electron holography are almost always lower than theoretically predicted values. This discrepancy is attributed primarily to specimen preparation damage and the presence of surface depletion layers. However, electron beam irradiation can also affect dopant potentials as a result of: i) positive charging of the specimen, ii) the generation of electron-hole pairs and iii) the creation of point defects Here, we assess the influence of electron beam damage on dopant potentials measured using off-axis electron holography. We present results obtained from a core-shell GaP nanowire p-n junction at accelerating voltages. Our results suggest that interstitial-vacancy pairs created by the high-energy electron beam contribute to the measured reduction in dopant potential.

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