NEW DEVELOPMENTS IN PHASE-SHIFTING ELECTRON HOLOGRAPHY

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Abstract

Electron holography provides a method of measuring both the amplitude and the phase of the electron wavefunction passing through a thin specimen in a transmission electron microscope by interference with a plane reference wave. From a single electron hologram the resolution of the wavefunction is limited by the spacing of the interference fringes.

In phase-shifting electron holography, a series of holograms is acquired from the same area of the specimen with the positions of the fringes in each hologram shifted with respect to the specimen being imaged by a fraction of the fringe spacing. The specimen wavefunction is reconstructed from the hologram series taking account of the fringe shift between each hologram. The spatial resolution of the amplitude and phase of the electron wavefunction reconstructed from a phase-shifting series of holograms is not limited by the hologram fringe spacing.

Here, we show how phase-shifting electron holography can be applied to a number of different samples at both medium and high resolution. We introduce a new approach for the analysis of phase-shifted electron holograms and discuss how a variety of different artefacts in the recovered phase images can be minimised.