In situ off-axis electron holography of magnetic nanoparticles — •Rafal E. Dunin-Borkowski, András Kovács, and Jan Caron — Ernst Ruska-Centre for Microscopy and Spectroscopy with Electrons and Peter Grünberg Institute, Forschungszentrum Jülich, Jülich, Germany

Off-axis electron holography is a powerful technique for recording the phase shift of a high-energy electron wave that has passed through an electron-transparent specimen in the transmission electron microscope. The phase shift is, in turn, sensitive to the electrostatic potential and magnetic induction in the specimen, projected in the electron beam direction. We are currently using the technique to characterize the magnetic properties of individual and closely-spaced deep-submicron-sized nanoparticles, nanostructures and thin films that are subjected to externally applied magnetic fields in situ in the transmission electron microscope, as well as to elevated and reduced temperature. We are also working on a model-based approach that can be used to reconstruct the three-dimensional magnetization distribution in a specimen from a series of phase images recorded as a function of specimen tilt angle using off-axis electron holography. We make use of a forward simulation approach within an iterative model-based algorithm to solve the inverse problem of reconstructing the three-dimensional magnetization distribution in the specimen from tilt series of two-dimensional phase images recorded about two independent tilt axes. In such applications of off-axis electron holography, the effects of electron beam induced charging and dynamical diffraction should be minimized.