Atomic Resolution Electron Tomography

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Visualizing the arrangement of atoms has played an important role in the evolution of modern science and technology. Crystallography has long been used to reveal globally averaged 3D atomic structures. Scanning probe microscopes can determine surface structures at atomic level. Electron microscopes can resolve atoms in 2D projections of 3D crystalline samples. In this talk, I will present a general method for 3D determination of *local* structures at atomic resolution. By combining scanning transmission electron microscopy with a novel data acquisition and 3D image reconstruction method, known as equal slope tomography (EST) (1), we achieve electron tomography of a ~10 nm Au nanoparticle at 2.4 Å resolution (2). We also observe nearly all the atoms in a Pt nanoparticle and image the 3D core structure of edge and screw dislocations in the nanoparticle at atomic resolution (3). In addition to materials science specimens, we also demonstrate that EST can be applied to improve the resolution and contrast for 3D imaging of biological and medical samples (4,5). We expect this general method to find broad applications in solid state physics, chemistry, materials sciences, nanoscience and biology.

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