***YY1.04**

Applications of Atomic-resolution, Low Dose-rate Electron Microscopy with Variable Voltage

Christian F. Kisielowski[1], Petra Specht[3], Bastian Barton[2]

1. Joint Center for Artificial Photosynthesis and National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, 2. Materials Science, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, 3. Department of Material Science and Engineering, University of California Berkeley, Berkeley, CA, USA

In recent years the TEAM Project (Transmission Electron Aberration-corrected Microscope) was concluded that was sponsored by the US Department of Energy. As a result a next generation electron microscopes of extraordinary performance is now operated at the National Center for Electron Microscopy (NCEM) with great success. These new instruments allow for dynamic studies (<1 kHz) with single atom sensitivity across the Periodic Table of Elements at a resolution limit around 0.5 Å [1-3]. Their unprecedented abilities also reveal that the image formation process is now limited at a fundamental level by the Coulomb scattering process itself and by beam-sample interactions. As a result, efforts to push for higher resolution are coming to an end and there is room for assessing the future of the field. This talk describes progress beyond resolution improvements that was recently made by highlighting new capabilities and concepts, which enable new scientific investigations addressing functionality at a single atom level. Instrumental advancements include the implementation of atomic-resolution, low-dose rate techniques at variable voltage (20 kV - 300 kV) [4] and atomic-resolution imaging at elevated temperature and pressure. Thus, it becomes feasible to study the functionality of materials and possibly of single molecules in chemically meaningful environments with atomic resolution and single atom sensitivity. Such capabilities are of general interest to material, chemical, and biological sciences. In particular, they can help to improve our understanding of artificial photosynthetic systems that will produce transportation fuels from sunlight.