PS-01.02.11 OMEGA ENERGY FILTERING TEM: APPLICATIONS IN QUANTITATIVE ELECTRON DIFFRACTION, C. Dettinger and J. Mayer, Max-Planck-Institut für Metallforschung, Stuttgart, Germany.

With imaging energy filters becoming commercially available in transmission electron microscopy many of the limitations of conventional TEM instruments can be overcome. Energy filtered images or diffraction patterns can now be recorded without scanning using efficient parallel (2-dimensional) detection. We have evaluated a prototype of the Zeiss EM 912 Omega, the first commercially available electron microscope with integrated imaging Omega energy filter. In quantitative electron diffraction the filter is used to remove the inelastically scattered electrons (elastic or zero-loss filtering) and by this quantifiable intensity data without background can be obtained. In selected area diffraction (SAD) weak reflections can be recorded even in thick samples. Another example is the determination of amorphous structure factors of amorphous materials. The most accurately quantifiable data can be obtained by elastically filtered convergent beam electron diffraction (CBED). Structure factor amplitudes and phases can be determined very accurately. For phase measurements in non-crystalline symmetric crystals, three beam patterns have to be used. For two-dimensional energy filtered data are necessary which (without scanning) can only be obtained with an imaging filter and a CCD camera as (linear) detector. From a whole set of such structure factors the charge density distribution in a crystal can be calculated. Furthermore, in the electron spectroscopic diffraction (ESD) mode of operation the angular distribution of inelastically scattered electrons can be imaged. This can be used in the ALCHEMI method to determine atom positions within a unit cell.

PS-01.02.12 DEVELOPMENT OF CCD-BASED AREA DETECTORS FOR MACROMOLECULAR CRYSTALLOGRAPHY USING SYNCHROTRON AND LABORATORY SOURCES, by Walter G. Philp, Martin Stanton, You Li, Dandan O'Mara, Jinhui Xin, Renowned Basic Medical Sciences Research Center, Brandeis University, Walpole, MA 02084-0010, Edwin. M. Westbroek, Isbom Nadal, Steve Ross, Mary L. Westbrook, Mikhail Kaino, Argonne National Laboratory, Argonne, IL 60439, and James W. Pligrath, Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 11724, U.S.A.

We are developing CCD-based area detectors for collecting macromolecular crystallographic data using synchrotron and laboratory sources. The basic unit of our detectors is a module which consists of a demagnifying fiberoptic taper with a phosphor x-ray converter bonded to the larger face of the taper and a CCD bonded to the smaller face. In order to achieve a large area, detectors are assembled from a number of identical modules. Currently, two detectors are being developed: (1) a high-performance detector for synchrotron applications, and (2) a detector in which a variable number modules can be assembled for a range of applications. The first detector is designed to have a large area and high spatial resolution. In each DCC is segmented into 900x900 pixel blocks. The module has a taper demagnification of 2:1, and uses a 1024x1024 pixel Tektronix CCD. As a result this detector has 3972x3972 50um pixels and a high DQE. The second detector is designed so that a single module will form a useful instrument at a reasonable cost, while multiple modules can be used to increase the efficiency of data collection. Each module has a 50x50 cm front surface and a taper demagnification of 4:1, providing a pixel size of 100 um with a 1024x1024 Tektronix CCD. Because of the larger taper demagnification and in this detector, the cost per unit area is lower, and the performance (as measured by the DQE) is decreased. In both detectors the CCDs are read out in parallel using two amplifiers on each CCD, with a total readout time 1.7 s for the array of up to 9 modules. The pixels can be binned, reducing the readout time to 0.4 s. Research was sponsored in part by the Division of Materials Sciences, US DOE under contract DE-AC05-840R21400 with Martin Marietta Energy Systems, Inc.