14.4-01 NOISE REDUCTION IN A LOW LIGHT LEVEL IMAGE INTENSIFICATION SYSTEM FOR ELECTRON MICROSCOPES. By J.D. Patterson and C.E. Warble, CSIRO Division of Chemical Physics, P.O. Box 160, Clayton, Victoria, Australia 3168.

To optimize the use of low light level image-intensification systems in the recording of either static or dynamic images produced in electron microscopes, the lowest possible level of introduced background noise is necessary. This seldom constitutes a problem in systems relying upon photographic plates.

In the authors' case, the plate chamber was removed from a 14-year-old Hitachi HU-125S in order to make real time recordings of reactions through the use of an image intensification system. While allowing recording of dynamic specimen situations and the use of magnifications of the order of 500,000x, the ability to take usable single micrographs was lost due to introduced electronic background noise.

Significant improvement in image quality was initially made by means of reducing the dark current and thus improving the signal-to-noise ratio of the Silicon Intensified Target (SIT) camera tube, by cooling its target (Patterson, J.D. Ultramicroscopy (1980), 5, 215). Figure 1 shows, at 140,000x, a typical "untreated" SIT image of an MgO crystal. Figure 2 is the same crystal after cooling of the SIT. While this improvement alone makes it possible to obtain usable single micrographs as well as significantly higher quality real time video or movie sequences, still further improvement was possible through the use of an Arlunya TF 4000 Temporal Filter and TV Frame Store (Dindima Pty. Ltd., 10 Argent Place, Ringwood, Victoria, Australia). This amounts to an electronic equivalent of the photographic integration method. It provides a more versatile facility because the photo integration times are continuously variable from 0.3 to 30 seconds, and the processed image can be observed either as a single static image or as a continuously changing image with update times dependent on the selected integration period. There is also facility for storing one image. The MgO crystal in Figures 1 & 2 is shown after Arlunya filtering without (Figure 3) and with (Figure 4) the SIT cooled.

The image obtained from the combined use of SIT cooling and Arlunya filtering makes a low light level image intensification system practicable, both as a source of single micrographs of qualities approximating those obtained from photographic plates, and as a means of achieving high quality video or movie recordings.

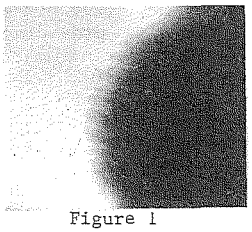
Figure 1

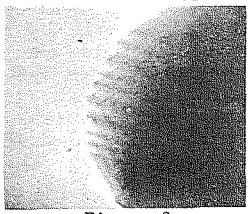
Figure 2

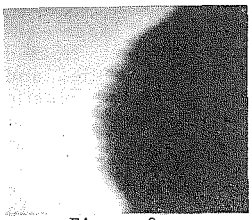
Figure 3

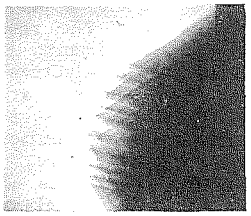
Figure 4

14.4-02 STUDY OF THE TWO-DIMENSIONAL ANTIPHASE STRUCTURES IN THE ORDERED ALLOYS BY HIGH VOLTAGE - HIGH RESOLUTION ELECTRON MICROSCOPY. II. By O. Terasaki and D. Watanabe, Department of Physics, Tohoku University, Sendai, Japan.

The two-dimensional antiphase structure (2d-APS) of the Cu_3Pd type has two kinds of antiphase boundaries: parallel to the (001) plane, and parallel to (100). Three alloy systems, Cu-Pd, Au-Zn and Au-Mg, have this type of structure in the composition ranges, 26-29 at.% Pd, 16-19 at.% Zn and 16-22 at.% Mg, respectively. Mean sizes of antiphase domains, M_1 and M_3, are not simple integral multiples of the unit cell size of basic Ll_2 structure (i.e., they are incommunsurate) and vary with composition. High resolution electron microscopy and diffraction studies of these three alloy systems were carried out on 1 MV electron microscope, and the incommensurate characters were clearly revealed by observing the atomic arrangements for different compositions and different M values through the high resolution superstructure images. There is a strong tendency to avoid the formation of nearest neighbour pairs of Mg (and Zn) atoms across the second kind of boundary in the Au-Mg and Au-Zn alloys, whereas no such tendency is observed in the Cu-Pd alloy. Based on these observations, structure models are proposed for the Au-Mg and Au-Zn, which are modifications of the originally proposed Cu_3Pd type 2d-APS.

14.4-03 CRYSTALLISATION OF MN,MG METASILICATES AS REVEALED BY HIGH RESOLUTION ELECTRON MICROSCOPY. By N.J.Pugh and D.A. Jefferson. Dept. of Physical Chemistry, Lensfield Road, Cambridge, U.K.

Where examination of materials crystallising from the amorphous state is undertaken, diffraction methods give only the broadest outline of the crystallographic features. Using high resolution electron microscopy, however, crystallisation can be observed at the ultrastructural level. One such study in the manganese/magnesium metasilicate system is described. Defect structures have been found in all chain type metasilicates, ranging from the pyroxenes (Iijima and Buseck Amer. Mineral. (1975) 60, 758), through the pyroxenoids (Alario-Franco et al. Mat. Res. Bull. (1980) 15, 73) to the wollastonite structure (Jefferson and Thomas, Mat. Res. Bull. (1975) 10, 761). It has been possible to resolve directly the atomic structure in some of these phases (Smith, Jefferson and Mallinson, Acta Cryst. (1981) A37, in press) although only under very restricted conditions. In the examination described, metasilicates with Mn:Mg ratios of 3:1 and 1:1 have been prepared in the glassy state from oxide melts and the crystallisation observed on annealing. During the growth process, the role of defects can be interpreted directly, even when a 1:1 correspondance between object potential density and image contrast is not achieved.

For the 3:1 composition, the glassy quench product is relatively stable and crystallisation only occurs after some 30