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-1250 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 the 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 Temperature and TV Frame Store (Bündima 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 recording both images. 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
minutes annealing at 800 °C. Initial nucleation is in the form of the pyroxene structure, which crystallizes with a perfect stacking arrangement. Further annealing however, causes this simple chain configuration to be interrupted by repeat units of the wollastonite structure, producing long-period pyroxenoids. With prolonged annealing the pyroxenoid chain repeat becomes the stable phase. Occasional stacking defects are noted but termination of a chain configuration within the crystals is never seen. For the 1:1 composition, the glassy phase is unstable and crystallizes under the influence of the electron beam. Initially, lattice fringes with a spacing corresponding to that of the octahedral framework of these structures are observed. Upon further exposure, a larger system of fringes with spacing characteristic of the pyroxene silicate chain appear. After annealing times of only two hours, the ordered pyroxene structure predominates.

The results are in complete accordance with the predicted structure/composition relationships in metasilicates. In all cases experimental evidence points to a constant anion framework which is set up on crystallization. Subsequent structure development and modification occur by diffusion of both octahedral and tetrahedral cations, a process which can be monitored directly by observation of the lattice images.