Letters to the Editor

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A Simplified Electron Microscope

C. H. BACHMAN AND SIMON RAMO
Electronics Laboratory, General Electric Company, Schenectady, New York
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AN electron microscope has been constructed to test a number of new methods of obtaining photographs. The aim has been to obtain in as simple a manner as possible both as regards operation and construction a resolving power in the range of the greatest present usefulness of electron microscopy (say ten times better than light microscopy), and to operate in a voltage range sufficient to obtain this resolution for the usual thin specimens. The instrument is a combined electron and light microscope and utilizes unipotential electrostatic electron lenses. Such a general scheme of design has proved to possess, as expected, the following desirable characteristics:

(1) The electrons are accelerated and focused by a single, crudely regulated voltage.

(2) The unipotential lenses can readily be used in a multiple-stage magnifying system of compact construction so that the chamber to be evacuated becomes very small.

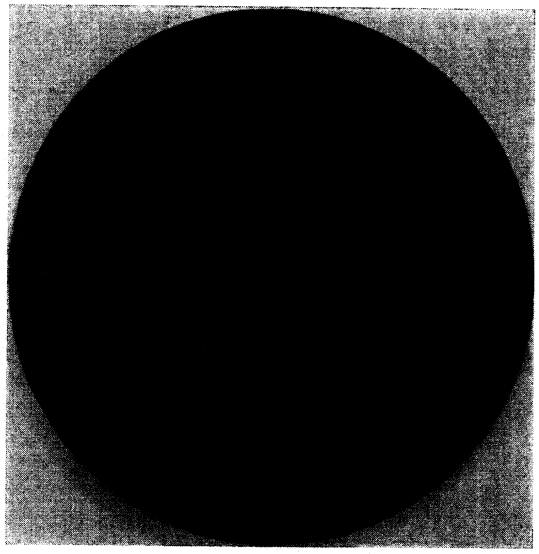

FIG. 1. Photograph of replica from specimen of carbonyl iron.

(3) A short electron path results from the use of a multiple lens electron-optical system in combination with a stage of light-optical magnification. This small cathode to fluorescent screen distance and the medium resolving power make it possible to align the entire electron-optical system permanently.

(4) The chamber can be re-evacuated to operating conditions within a few minutes after insertion of a new specimen. This and the external photographic technique which a final light-optics stage facilitates, eliminate the need for specimen and photographic film insertion locks.

(5) The over-all weight and dimensions, if proper advantage is taken of the above conditions, are such that it is feasible to design a portable instrument.

This approach to the electron microscope problem requires that one obtain fluorescent screen images capable of enlargement by light-optical means. Images on screens which have been prepared and used in this instrument are believed to be capable of 10–20-diameters enlargement. With the reduced electronic magnification (for a given final magnification), the fluorescent screen images are exceedingly bright for a given current density at the specimen. The apparent brightness of the image for visual observation remains nearly constant as the magnification in the light-optics stage is increased since the N.A. of the light lens increases in nearly the same proportion. The photographic exposure time is several times higher than for the conventional electron-on-film recording, usually being one-half minute or more.

Figure 1 is of a replica taken from a metallographic specimen of carbonyl iron.

A more detailed description of the design and development of this instrument will be published shortly in the *Journal of Applied Physics*.

Note on Induced Color in Diamonds

J. M. CORK
University of Michigan, Ann Arbor, Michigan
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IN a previous letter entitled "Induced Color in Crystals by Deuteron Bombardment"[1] the transformation in color (from amber to green) effected in diamonds was described as a body change. This conclusion resulted from the fact that light coming from the gem has suffered many internal reflections and hence has always passed through the green region. It has now been shown that the change in color does not extend throughout the body of the crystal.

Two identical amber tinted crystals, each of 2.8 karat and of distorted dodecahedral form and each with a flat basal surface of several square millimeters were available for irradiation. These gems were arranged with their basal planes in contact and mounted with one stone imbedded in wax so that all but the plane surface was covered, while the other was exposed to the deuteron bombardment. The upper stone was nicely transformed to green, while the under one was in no way discolored. This indicates that the alteration in color probably is produced only as deep as the penetration of the energetic deuterons.

[1] J. M. Cork, Phys. Rev. 62, 80 (1942).

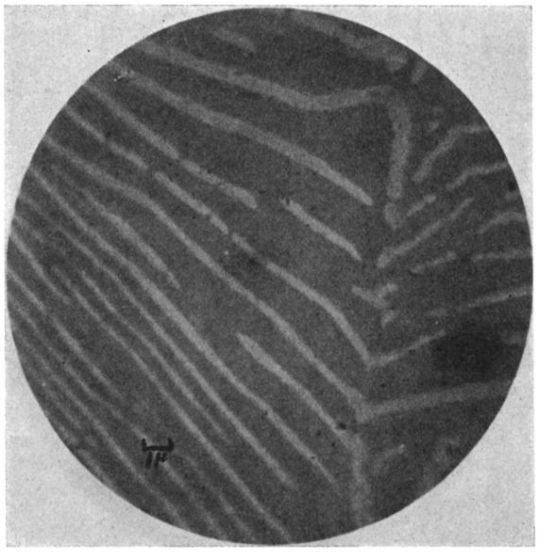

FIG. 1. Photograph of replica from specimen of carbonyl iron.