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ELECTRON MICROSCOPE STUDY OF GRAPHITE BROMIDE

by

P. DELAVIGNETTE (C.E.N.)
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ELECTRON MICROSCOPE STUDY OF GRAPHITE BROMIDE

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(Received 3 May 1963)

Graphite readily forms, by direct addition from the vapor, lamellar bromine compounds of complete bromine layers of two-dimensional structure between the carbon hexagon networks.[2,3] In stable compounds the layers are either filled to capacity or completely empty.[4] The bromine can be driven off merely by standing at room temperature or in vacuum. A proportion is retained tenaciously, giving rise to the so-called residue compounds. The way in which the residue compound retains the bromine is not known with certainty.

INDEXING CATEGORIES

A. graphite monocrystals	C. electron diffraction
B. graphite-bromine interlamellar compound	E
B. dislocations	
C. electron microscopy	

The emptying of complete bromine layers can be followed beautifully by observation in an electron microscope. Natural and purified single crystals of graphite were exposed to bromine vapor for some minutes and left standing for some days in order to have the pecularities caused by the intercalated bromine molecules observable. These crystals reveal isolated partial dislocations. The component of their Burgers vector in the foil plane, determined by extinction, lies in the $\{11\bar{2}0\}$ planes, compatible with the Burgers vector of the partial dislocations of the normal dislocation ribbons. They are highly mobile and have a low line tension as may be concluded from their irregular shape. A difference in stacking-fault contrast was observed between the regions on both sides of these dislocations. It is therefore thought that these dislocations bound the intercalated bromine layers and that the hexagon networks on either side of a bromine layer are in "*a* over *a*" stacking. This means that the Burgers vector will also have a component parallel to the *c*-direction with a magnitude that is not a simple fraction of the *c*-parameter.

On their way to the edge of the crystal the boundary dislocations leave behind numerous bromine loops of irregular shape by a mechanism clearly presented by the successive steps in Fig. 1. The loops are split off at places where the dislocations are pinned by crystal defects. They are stable in the electron microscope upon heating by an increasing beam intensity. Thus each layer is only partly emptied. Figure 2 shows how numerous loops are created one above the other from the pinning by bromine loops of succeeding boundary dislocations in different planes.

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[2]W. Rüdorff, *Z. Anorg. Allgem. Chem.* **245**, 383 (1941).

[3]J. Maire and J. Mering, *Proc. Conf. Carbon, Univ. Buffalo, New York, 1959.*

[4]S. A. Saunders, A. R. Ubbelohde, and D. A. Young, *Proc. Roy. Soc.* **A271**, 499 (1963).

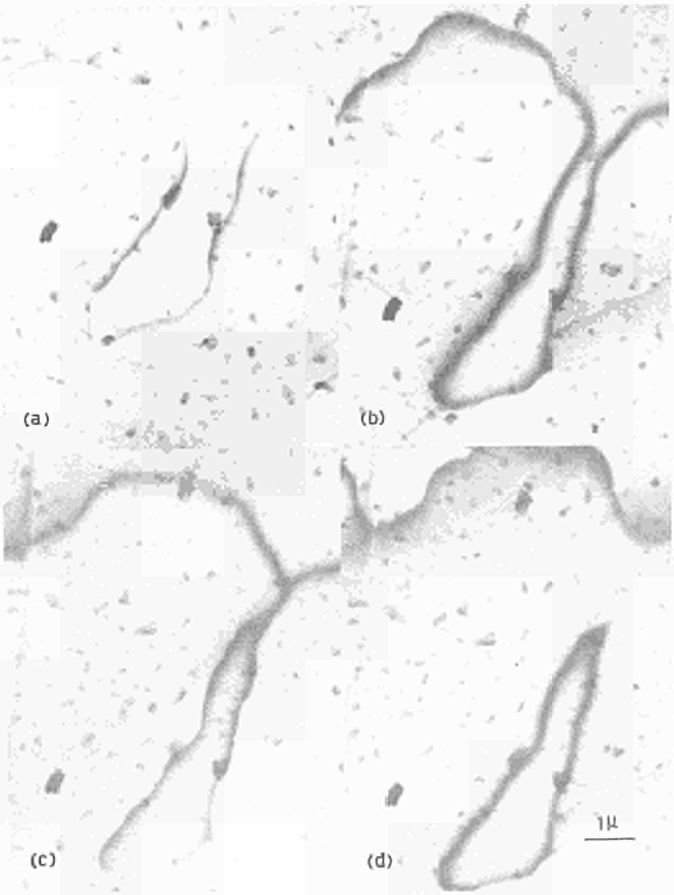

Fig. 1. Formation of a bromine loop by a moving partial dislocation bounding an intercalated bromine layer.

Fig. 2. Formation of numerous bromine loops in different planes one above the other by the process presented in Fig. 1.

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