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¹ Seal, M., *Nature*, **182**, 1264 (1958).

² Seal, M., Proc. Fourth Int. Conf. on Electron Microscopy, Berlin, 1958 (in the press).

Alleged Formation of an Intermediate Diamond Structure on Heating Diamond

It was shown by Seal¹ that little change was produced by heating natural diamond powders to 1,200° C. in a vacuum (10⁻⁴ mm. mercury) for periods of 15–30 min. Heating the powders to 2,000° C. resulted in a complete transformation to graphite. For temperatures of about 1,500° C. both diamond and graphite could afterwards be detected, and, in addition, the electron diffraction patterns showed extra spots not due to either diamond or graphite. Seal advanced the theory that these extra reflexions were due to some intermediate arrangement of carbon atoms in diamond, possibly a regular array of diamond and graphite-like regions.

X-ray diffraction patterns of the samples gave extra lines, by far the strongest of which corresponded with a lattice spacing of 2.51 Å. Also, it was stated that spectrographic analyses of the diamond powders before and after heating showed a chief impurity of 1 per cent silicon (Seal, M., private communication).

In a current programme of investigation diamond powders have been heated to about 1,400° C. in an inert atmosphere for various lengths of time. X-ray as well as spectrographic analyses of the powders before and after heating have confirmed the observation of Seal; but, in the light of our experiments, the existence of an intermediate atom structure in diamond after heat treatment can be discounted, and an obvious explanation for the extra X-ray reflexions and the increased silicon content of the heated diamond powder is given.

On measuring the extra lines of the X-ray pattern of the heated diamond powders the strongest reflexion was found indeed to correspond with a lattice spacing of 2.51 Å. In addition, two reasonably strong reflexions for spacings of 1.54 Å. and 1.31 Å. were found. Reference to the ASTM X-ray data card system identified these extra reflexions as being due, almost certainly, to silicon carbide.

This result is significant in the light of the fact that a chief impurity of 1 per cent of silicon is quoted by Seal for the heated diamond powders, whereas a silicon content of more than 0.1 per cent is seldom found for natural unheated diamond².

According to Tammann³ the reaction between silicon and carbon to form silicon carbide starts at 1,340° C.

It appears, therefore, that the extra X-ray reflexions as well as the high silicon impurity content of the heated diamond powder are attributable to the formation of some silicon carbide as a result of chemical reaction between the diamond powder and silicon at an elevated temperature. In Seal's experiments the heating was done in crucibles of pure graphite; but the silicon might have been present initially as a contaminant or might have originated from his

furnace. In our experiments, boats of fire-clay, which is essentially an aluminium silicate, were used for the heating, and it is very likely that at 1,400° C. or higher they react either with the pure diamond or a graphitized layer on the surface of the diamond to give silicon carbide.

In order to verify this a diamond powder was heated at 1,400° C. in a platinum spoon for several hours and analysed by means of X-rays as well as spectrographically. Extra X-ray reflexions were completely absent, and as can be seen from Table 1, the silicon content is not more than normally found in diamond powder.

Table 1

Diamond powder	Silicon content (percentage by weight)	Extra X-ray reflexions
Unheated	0.01	No
Heated to 1,400° C. in fire-clay boat	1.00	Yes
Heated to 1,400° C. in platinum spoon	0.04	No
Heated to 1,400° C. in fire-clay boat and treated in hydrofluoric acid	1.00	Yes
Heated to 1,400° C. in fire-clay boat and subjected to sodium-hydroxide-sodium nitrite fusion	0.01	No

A further test was done to substantiate whether, in fact, silicon carbide is formed and whether the increased silicon content of the powder heated in the fire-clay boat is not just a result of contamination from the latter.

The heated powder was treated for several hours in hot hydrofluoric acid which digests silicon in any form except as the carbide. The extra X-ray reflexions and high silicon content of the powder remained unaltered as is evident from Table 1. On subjecting this powder to a sodium hydroxide-sodium nitrite fusion which is capable of removing silicon carbide, the silicon content, as depicted in Table 1, becomes normal again and the extra X-ray reflexions are absent.

From the above considerations it is evident that the extra X-ray and electron diffraction spots observed by Seal in heat-treated diamond powders are due to the existence of easily detectable amounts of silicon carbide as a result of chemical reaction at elevated temperatures.

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¹ Seal, M., *Nature*, **182**, 1264 (1958).

² Raal, F. A., *Amer. Mineral.*, **42**, 354 (1957).

³ Tammann, C., *Z. anorg. Chem.*, **115**, 141 (1921).

Emission and Absorption of Light behind the Detonation Front

WHEN a high explosive detonates, the measurement of the true emission of light from the detonation gases is of great interest. In air, however, the expanding detonation gas is enveloped in a compressed layer of the displaced air, which acquires a high temperature (c. 8,000° K. at atmospheric pressure) and emits an intense light. An easy way of eliminating the luminous layer of air is to immerse the charge in water. Charges of TNT and phlegmatized PETN, for example, then show a narrow luminous zone