LETTERS TO THE EDITORS

CRYSTALLOGRAPHY

Transformation of Cubic Boron Nitride to a Graphitic Form of Hexagonal Boron Nitride

R. H. WENTORF[1] has reported that a fragment of borazon (synthetic cubic boron nitride) was twice heated to over 2000°C. *in vacuo* without change. Dr. Wentorf was kind enough to supply us with some small specimens, both black and yellow. Some of these, which gave random-rotation X-ray photographs showing them to be twins (only two nearly single crystals were found), we heated in graphite specimen holders in a high-frequency vacuum furnace (10^{-5} cm. mercury) in a series of experiments to compare their behaviour with that of diamonds of various kinds. Table 1 shows the effects given by subsequent X-ray powder photographs.

TABLE 1

Temperature	Time	Effect on boron nitride crystals
1500°C. (±20°)	5 min.	no change
1650°C.	3 min.	partial conversion to a hexagonal form of boron nitride
1800°C.	1 min.	complete conversion
2000°C.	1 min.	complete conversion
2200°C.	flash	complete conversion

The crystals retained their shape after conversion, but yellow crystals turned black. The partially converted and some of the specimens completely converted at 1800°C. showed preferred orientation, which Laue photographs indicated was of the same kind as that found for partially graphitized diamond. We hope to check this later on untwinned specimens.

R. S. Pease[2] has proved that the normal form of hexagonal boron nitride has atoms in positions N: 0,0,0 and $\frac{1}{3},\frac{2}{3},\frac{1}{2}$; B: 0,0,$\frac{1}{2}$ and $\frac{1}{3},\frac{2}{3}$,0. This form of boron nitride could not have transformed to cubic boron nitride (as graphite could to diamond) by a process of translation, compression and buckling of the hexagonal layers. Successive layers would first require to be rotated through 60° relative to each other, and this would mean considerable breaking up of the structure.

It is, however, noteworthy that the hexagonal boron nitride produced by heating the cubic form *in vacuo* is not the normal form. It is a graphitic form, in which, although the 000*l* and $11\bar{2}0$ reflexions are sharp, the $10\bar{1}0$ and $10\bar{1}1$ form a single diffuse line, and $10\bar{1}2$ is very weak compared with 0004. The higher-angle reflexions rapidly fade in intensity. In these respects it is similar to the graphite formed by heating diamond *in vacuo*, which is not quite like terrestrial graphite, but is similar to the graphite found in meteorites[3].

The spacings of the graphitic boron nitride show that the unit-cell dimensions are identical with those of 'normal' hexagonal boron nitride. They are easily distinguishable from those of graphite itself, so that it was possible to prove conclusively that no contamination by the graphite crucible had occurred.

Specimens of normal hexagonal boron nitride (powder) were also heated similarly. No change except a slight annealing occurred up to 1800°C., but in experiments carried out at 2200°C., part of the specimens disappeared. X-ray photographs of the remains in the crucible showed that they had formed boron carbide, with the release of nitrogen. These experiments will be described in more detail elsewhere.

We are grateful to the Director of the A.E.I. Research Laboratory and to Dr. G. A. Geach, head of the Physical Metallurgy Section, for the facilities provided for heating the specimens.

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[1] Wentorf, jun., R. H., *J. Chem. Phys.*, **26**, 956 (1957).
[2] Pease, R. S., *Acta Cryst.*, **5**, 356 (1952).
[3] Grenville-Wells, H. J., *Mineralog. Mag.*, **29**, 803 (1952).

PHYSICS

Measurement of Asbestos Dust Concentrations with the Long-Running Thermal Precipitator

TESTS with a number of instruments in different factories have demonstrated that the long-running thermal precipitator of the type described by Hamilton[1] is a convenient instrument for measuring concentrations of asbestos dust in the atmosphere of card rooms, fiberizing departments and in other areas where the presence of asbestos dust may constitute a health hazard.

In this instrument, air is metered in cycles (which are intended to simulate breathing) through an elutriator and past a heated wire. Dust is deposited on a cover-slip, the heavier particles separating by elutriation and the finer particles being deposited by thermal precipitation at the end of the deposition area. The concentration of asbestos is determined by examining measured areas of the deposit microscopically and counting fibres of prescribed length.

Table 1 shows results which have been obtained with separate instruments in two different factories; one in Yorkshire, processing chrysotile asbestos; and the other in Essex, processing amphibole asbestos.

Table 1. ASBESTOS FIBRES/C.C. OF AIR (LENGTH-RANGE 5–100 μ)

	Duration of test	No. of tests	Fibres/c.c. average	Coefficient of variation (%)
Yorkshire Factory (Textile Dept.)	1 hr.	20	9·8	11
	2 hr.	20	4·7	18
Essex Factory (Fiberizing Department)	½ hr.	39	3·7	56
	1 hr.	41	3·4	49
	2 hr.	40	2·8	43

It will be seen that the calculated number of particles per c.c. of air appears to decrease as the running time of the precipitator increases. It is suspected that this may result from fibres being blown or washed off the slide by the air passing back over the deposit during the 'exhalation' part of the cycle.

Effects of this type have been noted with the Owens jet dust counter which works on the impingement