arms, and such events would be difficult to identify in the present experiment where thin emulsions were employed.

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Possible Emission of the Dineutron in Fission

PROF. N. FEATHER[1] has suggested that, if the dineutron exists, it may be emitted in fission and therefore be present in pile radiations. Further, it is pointed out that bismuth-209 would be a suitable detector for the dineutron, in that it produces actinium C, which has an alpha activity of 2·16 min. half-life readily observable in the presence of other activities produced in the irradiation.

$$Bi^{209} + n_0^2 \rightarrow AcC^{211} \xrightarrow[\alpha]{2{\cdot}16\text{ min.}} AcC'' \xrightarrow[\beta]{4{\cdot}8\text{ min.}} Pb^{207}$$

$$Bi^{209} + n_0^1 \rightarrow RaE^{210} \xrightarrow[\beta]{5\text{ days}} Po^{210} \xrightarrow[\alpha]{140\text{ days}} Pb^{206}$$

We have carried out two 10-min. irradiations of bismuth in the Harwell pile at a point where the thermal neutron flux was about 10^{12} neutrons per sq. cm. per sec. and where only 2 mm. of aluminium separated a piece of uranium from the bismuth. Two minutes were required to remove a detector and insert it in an argon-filled proportional counter. A high-frequency amplifier and discriminator fed any alpha-particle pulses into a scaler. In neither of the irradiations was there any evidence of actinium C activity. The growth of the polonium activity from the radium E was observed over several days.

Let φ_2 be the flux of dineutrons at the detector and σ_2 the absorption cross-section of bismuth for them. Then

$$\varphi_2\sigma_2 = \frac{N_2}{N_1} \cdot \frac{R_1}{R_2} \cdot \varphi_1\sigma_1 \text{ (for a thick detector),}$$

where N_2, N_1 are the observed counting-rates of actinium C and polonium corrected to long irradiation time; R_2, R_1 are the ranges in bismuth of the actinium C and polonium alpha-particles; φ_1 is the thermal neutron flux at the detector and σ_1 the capture cross-section of bismuth for thermal neutrons. Using $\sigma_1 = 0{\cdot}015$ barn, we conclude from two irradiations that $\varphi_2\sigma_2 < 1{\cdot}5 \times 10^{-21}$ sec.$^{-1}$.

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Crystal Structure of Boron Nitride

THE accepted structure of boron nitride, proposed by Hassel[1] and Brager[2,3], is that of graphite with the carbon atoms replaced by boron and nitrogen atoms, and is designated structure type *B*.12 in the "Strukturbericht"[4]. This structure does not give a good agreement between observed and calculated intensities; and as the original work is open to other criticisms, a complete redetermination has been carried out. It is concluded that the Hassel structure is incorrect.

Powder photographs of recrystallized boron nitride were obtained with copper and manganese *K*-radiation. Lines corresponding to twenty-eight diffraction planes were obtained, and these can all be indexed on the basis of a hexagonal unit cell with dimensions at 35·5° C. of $a = 2{\cdot}5038 \pm 0{\cdot}0001$ A., $c = 6{\cdot}660 \pm 0{\cdot}001$ A. Intensity measurements were made from the photographs using a calibrated microphotometer, and also with a Geiger counter spectrometer. From these data and the density[5] it can be readily shown that boron nitride has a layer structure with an inter-layer spacing of $\frac{1}{2}c$; each layer consists of a flat network of B_3N_3 hexagons.

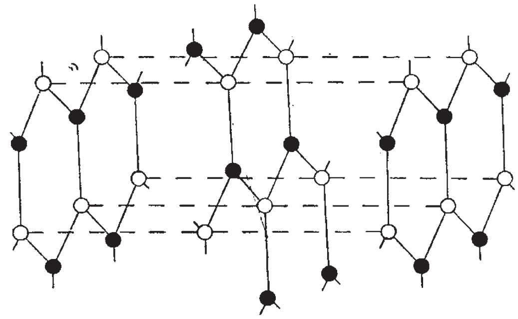

Fig. 1. Hassel structure of boron nitride
●, Boron atom; ○, nitrogen atom

These layers can be packed in four ways which satisfy the unit cell symmetry. Three of these ways are simply different arrangements of the boron and nitrogen atoms among the sites occupied by carbon atoms in graphite; the one favoured by Hassel and Brager, which fits the observed intensities least badly, is shown in Fig. 1. Fig. 2 shows the fourth way. This is a new type of packing, in which the hexagonal rings are packed directly on top of each other, the positions of the boron and nitrogen atoms being interchanged in adjacent layers. Comparison of the observed with the calculated intensities shows conclusively that boron nitride has this new type of packing, and not the graphite type.

The most striking consequence of this difference between boron nitride packing and graphite packing is

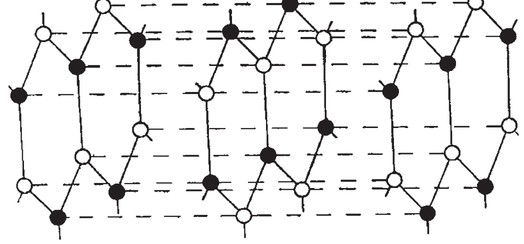

Fig. 2. New proposed structure of boron nitride