

ON THE GROWTH OF ARTIFICIAL DIAMOND CRYSTALS

CRYSTALLOGRAPHY

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Fig. 1

Figure 1: Fig. 1

Abstract**Full Text**

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CRYSTALLOGRAPHY

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ON THE GROWTH OF ARTIFICIAL DIAMOND CRYSTALS*(Presented by Academician N. V. Belov, 11 XII 1967)*

According to goniometric data and idealized models, the growth forms of diamond crystals in metal-carbon systems are simple and combination forms of the geometrically continuous cube-octahedron series. Giardini and Tydings⁽¹⁾ confirmed the conclusion of Bovenkerk et al.⁽²⁾ on the regular relationship between the form of diamond crystals and the temperature of formation, and determined the P - T boundaries between the regions of formation of cubooctahedral, octahedrocubic, and octahedral crystals in the Ni-C system. They also showed that in the Mn-C system exclusively octahedral crystals crystallize. Establishing the relationship of the form and properties of crystals with the conditions of their formation is important in studying the features of growth of artificial diamond crystals.

Fig. 1

In the geometrically continuous cube-octahedron series we have distinguished forms that we shall regard as the principal crystallographic types of artificial diamond (Fig. 1): 1 -cube; 2 -cube with slight development of the truncating faces of the octahedron; 3 -cube with significant development of the truncating faces of the octahedron; 4 -cubooctahedron (geometrically "equilibrium" form); 5 -octahedron with significant development of the truncating faces of the cube; 6 -octahedron with slight development of the truncating faces of the cube; 7 -octahedron. In the Ni-C system the P - T boundaries between the regions of formation of crystals of each of the distinguished types have been determined. It also turned out that the relative arrangement of the regions of formation of each of the distinguished types is analogous for other solvents,

with the use of which a whole series of cube-octahedra is realized (Fig. 2). A feature of the resulting diagram is the narrowing of the regions occupied by each type to the region of the intermediate, geometrically "equilibrium" type.

Fig. 2

Figure 2: Fig. 2

In the case of the Mn–C system, data were obtained that confirm the results of Giardini and Tydings.

Fig. 2

The data obtained can be interpreted from the standpoint of the solvent concept (3). According to this concept, the metals used in the artificial production of diamond are solvents of graphite and diamond. The cause of the formation and growth of diamond crystals in carbon–metallic-solvent systems is supersaturation of the solvent with carbon relative to diamond, arising during the dissolution of graphite as the difference between the solubilities of metastable graphite and diamond. This agrees with thermodynamic principles.

Since different forms are produced at the same values of supersaturation, the reason for the regular relationship between crystal form and formation conditions should apparently be sought in differences in the solubilities of differently named faces and, as a consequence, in their different growth rates.

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CITED LITERATURE

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3. N. I. Khitarov, *Geochemistry*, No. 9, 1138 (1966).

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