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1969

SovietRxiv

Abstract

Full Text

PHYSICS

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SYNTHESIS OF DIAMONDS OF THE "CARBONADO" TYPE

It was recently reported ([1]) that polycrystalline diamond formations of the "ballas" type had been synthesized. Some properties of these diamonds are discussed in ([2]). It is known that diamonds of the "carbonado" type occur in nature. According to the modern classification, ballas is defined as a polycrystalline spherical aggregate of fine-grained structure, whereas carbonado consists of still finer-grained diamond formations, which on X-ray diffraction patterns give a halo, as do amorphous bodies ([3]). The typical microstructure of ballases synthesized under laboratory conditions is shown in Fig. 1. Here the light field is diamond, and the dark field is inclusions. Natural carbonados have the microstructure shown in Fig. 3a.

Fig. 1
Fig. 1. Microstructure of artificial ballas. 450×

Fig. 2
Fig. 2. Carbonado grown in the form of a cylinder, $h = 4$ mm

As far as we know, we have for the first time synthesized diamond polycrystalline formations having a microstructure similar to that of natural carbonados. The similarity of the microstructures of the obtained specimens (Fig. 3b, c) to the microstructure of natural carbonado makes it possible to call the obtained specimens diamonds of the carbonado type. In the X-ray diffraction pattern taken by us of artificial carbonado, the internal halo characteristic of carbonado is visible ([4]). It should be noted that, in synthesizing artificial carbonado, conditions can be chosen under which the entire reaction volume is transformed into diamond; consequently, the obtained specimens may have a prescribed shape that repeats the shape of the reaction volume. This is of great practical significance. Figure 2 presents a photograph of cylindrical carbonado.

Fig. 3. Microstructure of carbonado: natural (a) and synthesized (b and c). 450×

In conclusion, it may be noted that cutters made of artificial carbonado can machine, with high purity, such materials as ceramics and hard alloys.

Fig. 3. Microstructure of carbonado: natural (a) and synthesized (b and c). 450×

Figure 1: Fig. 3. Microstructure of carbonado: natural (a) and synthesized (b and c). 450×

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Received
11 XI 1968

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Note: Figure translations are in progress. See original paper for figures.