

FORMATION MECHANISM AND STABILITY OF FULLERITE CRYSTALS C₆₀

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Introduction

It is known fullerenes are not quite stable molecules. They may be destroyed easily by oxygen and light. As for crystalline fullerene substances the last are more stable. Fullerenes are the most investigated modern material and the huge number of publications was devoted to them. But the mechanism of crystalline fullerenes formation is not quite clear yet.

Results and discussion

We have investigated structural features of synthetic fullerite C₆₀ by means of X-ray methods with 10 years time brake and morphological particularities with electron scanning microscopy. The initial fullerite substance was produced by the method of evaporation of pure C₆₀ toluene solution at 60-70 °C.

The fullerite crystals have octahedral habit and usually have sizes 50-100 mkm, they may form parallel tight aggregates with the total sizes up to 500 mkm. We have taken a special attention to a fullerite surface. It is presented by quite smooth plates but with numerous globules of 100-500 nm in size. The globules often are independent and have good spherical forms. And when they are set close each to other they are coagulated together to larger particles. When the quantity of the coagulated globules became very large they form a new lay on the fullerite crystal surface. The chemical composition was controlled by microprobe analysis of the specimens.

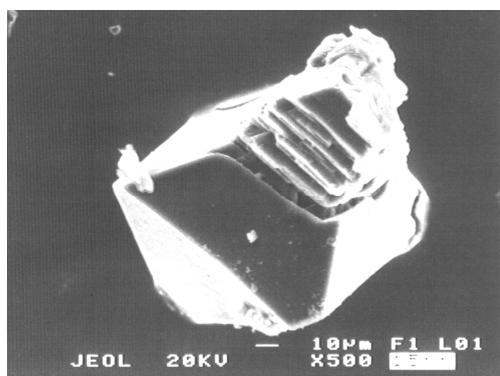


Fig.1. Fullerene crystal C₆₀

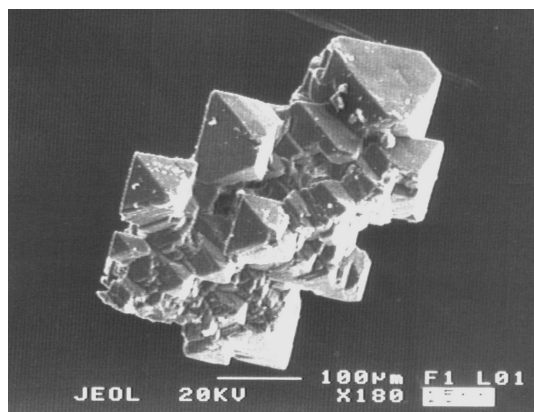


Fig.2. Parallel aggregate of fullerene crystals C₆₀

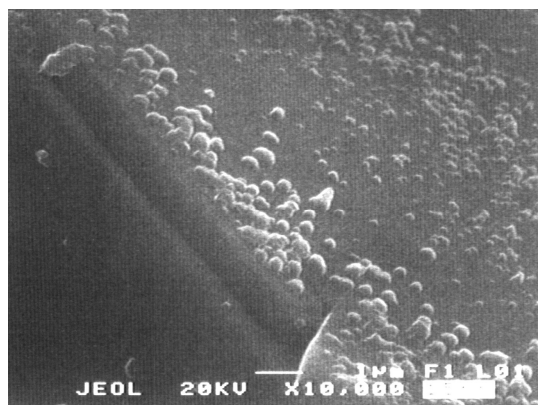


Fig.3. Globules on the fullerite crystals surface

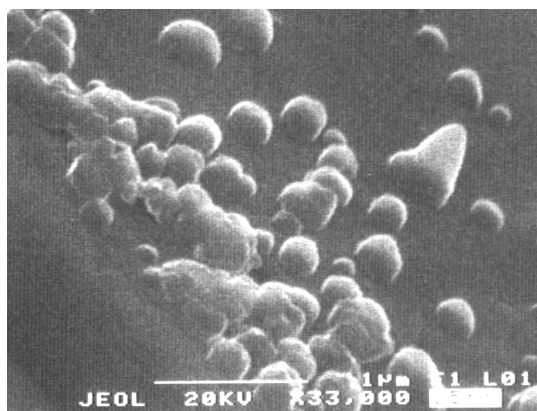


Fig. 4. Spherical form of the globules

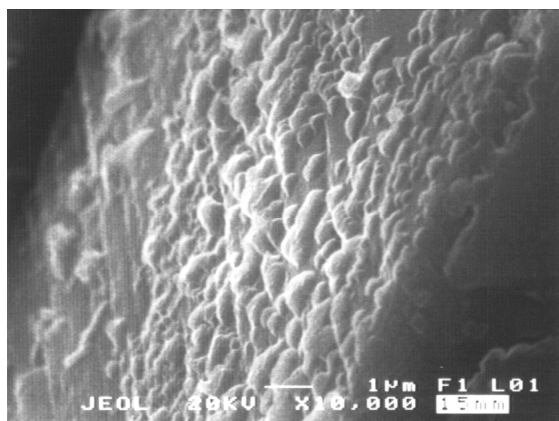


Fig. 5. Fullerene crystal surface with coagulating globules

According to the received data the formation of fullerite crystals were produced by spherical carbon globules, their coalescence to the new lay and following crystallization with a fullerite seed to a single crystal.

Structural features of the fullerite specimens were investigated by X-ray diffractometry, Debye powder and Laue single crystal methods. The provided analysis have allowed to recognize that the fullerite represented by single structured crystals and they keep their structure during 10 years, the interplanar distances are saved, some

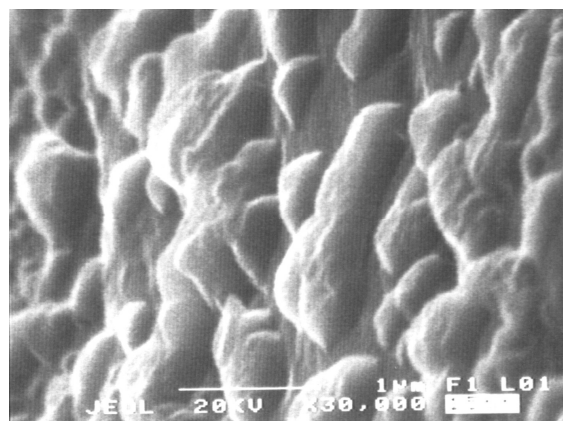


Fig. 6. Coagulating globules

difference between the experimental X-ray data and fullerite diffraction database is no more than the standard instrumental error.

Conclusion

Thus, the results allow understand the mechanism of the fullerite crystals formation and the measure of their stability.

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