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Diamond formation through carbonate-silicate interaction

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ABSTRACT

Crystallization of diamond and graphite from the carbon component of magnesite, upon its decarbonation in reactions with coesite and enstatite at pressures of 6–7 GPa and temperatures of 1350–1800 °C has been accomplished experimentally. In a series of experiments, diamond was obtained in association with enstatite, coesite, and magnesite, as well as with forsterite, enstatite, and magnesite. Octahedral diamond crystals with sizes up to 450 μm were studied by FTIR spectroscopy and were found to contain nitrogen and hydrogen, which are known as the most abundant impurities in natural type Ia diamonds. We found that growth of diamond on the cubic faces of seed crystals proceeds with formation of a cellular surface structure, which is similar to natural fibrous diamonds. The isotopic composition of synthesized diamonds ($\delta^{13}C = -1.27‰$) was determined to be close to that of the initial magnesite ($\delta^{13}C = -0.2‰$).