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Study of reactive hydrocarbon radicals in microwave plasma CVD for synthesis of single crystal diamond HIDEAKI YAMADA, Diamond Research Lab., AIST, Japan, AKIYOSHI CHAYAHARA, YOSHIAKI MOKUNO, NOBUTERU TSUBOUCHI, SHIN-ISHI SHIKATA, DIAMOND WAFER TEAM
— Microwave plasma chemical vapor deposition (MWPCVD) for synthesis of single crystal diamond (SCD), which is operated under quasi-atmospheric pressure, is studied by using numerical simulation. By limiting our interest into the discharge condition which enables to achieve simultaneous improvements of the growth-rate and crystal quality, we simplified the model to prescribe the MWP as much as possible. While the model is simplified, several results seem to be consistent with those given by other models. On the other hand, results of the present model are compared with some experimental results of the SCD growth. Dependences of the species concentrations on the power density and percentage of methane in the feedstock gas mixture are estimated. The calculated results show that the increase of the power density gives simultaneous increases of the absolute concentration of the methyl radical and relative concentration of the atomic hydrogen. The former is considered to be one of the important precursors for the growth, and the later is important for the removal of the non-SCD component during the growth. Therefore, this result is considered to be closely related to mechanism of the simultaneous improvements which have been observed in several experiments.

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