# Residual Gas Composition during Diamond Deposition with a New Developed Microwave Surface Wave Plasma Source

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Microwave plasma chemical vapor deposition (MPCVD) has made great progress, and is considered as one of the most promising techniques for mass production of large size and high quality single and/or poly crystalline diamond [1-4]. Homoepitaxial growth of single crystalline diamond by MPCVD has been reported to obtain inch-size diamond with fast growth rate and improved diamond quality [5]. Nanodiamond has many distinctive inherent properties such as high hardness, superior thermal conductivity, high refraction index, and extraordinary resistivity, allowing it to be a promising material for various kinds of applications [6]. However, the growth parameters, like deposition temperature, pressure, feeding gas composition and microwave power, have a strong influence on the morphology and crystal quality of the growth surface [3].

The objectives of this work is to investigate the influence of residual gas composition on deposited diamond film parameters [7] during MPCVD with a compact surface wave plasma(SWP) source [8-9]. The newly developed SWP source is employed for diamond film deposition with H2/CH4 operation. Stable plasma is maintained in conditions of different flow rates and 2-2.5 kW microwave power range. Decompositions of CH4/H2 are measured with residual gas analyzer (RGA). Microwave plasma parameters are also measured with fast-scanning Langmuir probe. Wafer temperature is controlled with sample heater. Deposited films characterizations are investigated at different CH4/H2 ratios, operating pressures, flowrates and wafer temperatures. Optimum mode of SWP source operation for diamond films deposition is discussed.

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