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Growth behavior of CVD diamond films with enhanced electron field emission properties over a wide range of experimental parameters

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In this study, diamond films were synthesized on silicon substrates by microwave plasma enhanced chemical vapor deposition (CVD) over a wide range of experimental parameters. The effects of the microwave power, CH₄/H₂ ratio and gas pressure on the morphology, growth rate, composition, and quality of diamond films were investigated by means of scanning electron microscope (SEM), X-ray diffraction (XRD), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). A rise of microwave power can lead to an increasing pyrolysis of hydrogen and methane, so that the microcrystalline diamond film could be synthesized at low CH₄/H₂ levels. Gas pressure has similar effect in changing the morphology of diamond films, and high gas pressure also results in dramatically increased grain size. However, diamond film is deteriorated at high CH₄/H₂ ratio due to the abundant graphite content including in the films. Under an extreme condition of high microwave power of 10 kW and high CH₄ concentration,

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