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Fabrication of Patterned Diamond Field Emitter Tips using Silicon oxide barrier

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There is great effort to achieve electron emission from chemical vapor deposited (CVD) polycrystalline diamond film. This is because diamond possesses high chemical stability, extraodinary hardness, high thermal conductivity, and low electron affinity[1]. In this report we present a method for fabricating a patterned diamond tips array. Selective depositon of CVD diamond film is an important technique in the fabrication of diamond electron devices. We have used silicon oxide to block the lateral growth of diamond to selectively grow a diamond film field emitter arrary.

A (100)-oriented silicon wafer was deposited with diamond seeds by conventional scratching method fellowed by deposition of 4㎛ thick silicon oxide film using E-beam evaporator. Then, a 1.2 ㎛ thick photoresist was coated and patterned into 2.7 ㎛ thick diameter negative discs using a conventional photolithography. The exposed silicon oxide layer was anisotropically etched by reactive ion etcher (RIE) using CHF_3+C_2F_6, so that the oxide layer can used as a barrier to block the lateral growth of diamond. The diamond was synthesized using microwave plasma-enhanced CVD at 950 ℃. The source gases were CH_4 and H_2. The gas flow rates of CH_4 and H_2 were 2.5 sccm and 100 sccm, respectively. During the growth, diamond was doped with boron. The gas pressure was kept at 90 Torr and the microwave power 600 W. Because a diamond film can not grow on a silicon oxide, an array of diamond rod

was formed as originally patterned. The height of diamond could be controlled by the growth time. To remove the oxide layer and to improve the emission characteristic, the surface was treated with hydrogen plasma [2]. Figure 1 is a scanning electron microscope (SEM) micrograph of the patterned diamond rod. The current-voltage characteristic of the patterned diamond array will be presented .

REFERENCE

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FIG.1. SEM Micrograph of the patterned diamond rods