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Selective Growth of Polycrystalline Diamond Thin Films Using Bias-Enhanced MPCVD

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Polycrystalline diamond thin films have been selectively grown on mirror-polished silicon substrates using bias-enhanced microwave plasma chemical vapor deposition (MPCVD) to increase diamond nucleation density. Shallow etching of the SiO_2 mask was employed after the nucleation treatment to remove the diamond nuclei from the mask. Perfect diamond patterns with smooth surfaces (particle size < 0.5 μm) and sharp boundaries were obtained. Diamond film gears 400 μm in diameter and 5 μm in thickness were fabricated for the first time using the technique described above.

1. Introduction

Chemical-vapor-deposited diamond films have great potential for application in electronic, optical and micromechanical devices because of the unique properties of diamond. Film patterning is one of the basic processes for fabricating the devices. Diamond is highly resistant to chemical solutions, therefore, it is very difficult to pattern by chemical etching. Plasma and laser etching are alternative techniques, but both require sophisticated and expensive equipment. Selective growth may be the most viable technique to achieve