HIGH QUALITY DEEP ETCHING OF DIAMOND: PROCESS OPTIMISATION OF AN ITERATIVE AR/O\textsubscript{2} AND AR/Cl\textsubscript{2} ICP REACTIVE ION ETCH FOR POWER DEVICE FABRICATION

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Reactive Ion Etching (RIE) has emerged as a preferred method for diamond substrate surface treatment and device patterning. This process is crucial to achieve the fabrication of high power devices fully exploiting the exceptional properties of diamond. The material properties of diamond however pose challenges to achieving smooth etched surfaces, especially for etch depths beyond 2 microns. Following work optimising Inductive Coupled Plasma RIE etching for surface smoothing and removal of sub-surface damage, an investigation into the effects of etch process parameters on diamond patterning is pursued. The aim is the achievement of deep etching with controlled wall angle, minimized micro-masking and etched surface damage. More specifically, the impact of gas ratio and ICP power settings on the physical and chemical properties of the etch is studied with relation to mesa quality. Results highlight the importance of high platen/ICP power ratio, increased O\textsubscript{2}/Ar gas ratio and intermittent Ar/Cl\textsubscript{2} plasma to reduce damage and micromasking on the etched surface, producing a high quality smooth 8 micron deep etch.

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