

Characteristics of micro plasma jet in SEM and its applications

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論文内容の要旨

This research proposes a DC gas discharge operated in a micro gas jet, and injected into an electron microscope chamber. Gas was injected through a few 20-50 μm orifice gas nozzle (OGN), and was evacuated by an additional pump in order to keep the high vacuum environment. Gas discharge was then ignited between the OGN anode and a counter electrode Silicon (Si) wafer. There were two discharge modes that were observed by the oscilloscope during experiment: continuous discharge mode and self-pulsing discharge mode. The characteristics of a real time plot of voltage and current during the self-pulsing discharge mode was investigated. The DC micro plasma jet was then subsequently applied for micro plasma processing—local sputter etching and local thin-film deposition. Thus, the characteristics of local sputter etching and thin-film deposition by micro plasma jet were studied. A local, hydrogenated amorphous carbon thin-film was deposited on the silicon wafer with a high deposition rate of Acetylene plasma (10 times higher than conventional PECVD); however, plasma could not be sustained for long operation time due to the deposition of the insulator thin-film covering the silicon cathode. A few 100 μm sputter etching area, dependent on the orifice hole size and gas profile, could be obtained with a high sputtering rate of Argon plasma, due to a higher current density (70mA/cm²) compared to that of the conventional method by 35 times approximately.