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 20-50Ø 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 Ø 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.