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Evaluation of absolute charge density at the bottom of hole pattern using high aspect ratio capillary plate MAKOTO MORIYAMA, NAOYA NAKAHARA, Nagoya university, HARUKA SUZUKI, Nagoya university, cLPS Nagoya university, HIROTAKA TOYODA, Nagoya university, cLPS Nagoya university, NIFS — In recent years, high aspect ratio hole etching by reactive ion etching (RIE) using capacitively coupled plasma (CCP) has become extremely difficult in the fabrication of 3D NAND memory devices. Particularly, abnormal profiles caused by ion orbital deflection due to positive charge-up inside the hole pattern is a great issue. To solve this, it is important to understand ion behavior inside the hole and the charge-up mechanism. In this study, high frequency voltage at the bottom of the hole patterns on the CCP cathode electrode is measured to evaluate the absolute density of the positive charge accumulated at the hole bottom. A lead-glass capillary plate with an electrode on the bottom, as a model of hole pattern, is placed on the cathode via an insulated alumina plate. Voltage on the plate bottom is measured using a high-voltage probe inserted through an isolated and vacuum-sealed feedthrough. The charge density is evaluated from a one-dimensional equivalent circuit model using the measured voltage, plasma potential and the plate capacitance.

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