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Deep Silicon Trench Oxidation in Downstream of Surface-wave Oxygen Plasma HARUO SHINDO, JYUN KOIKE, YUUTO IGARASHI, Tokai University — The shallow trench isolation (STI) technique in ULSI is inevitable to realize further integrations. However, a filling technique of insulation materials into trench by chemical vapor deposition (CVD), which has been conventionally employed in STI, becomes more severe. A direct oxidation of the trench surfaces by plasma is one of the candidates and this should be ion-assisted for directionality but with low damage. In this work, a silicon trench oxidation is investigated by employing a microwave oxygen plasma downstream under the condition of radio-frequency bias as well as the DC. In particular, the radio-frequency bias and the DC are superimposed and applied onto the substrate with the trench structure, and the oxidation rates at various portions of trench are examined as a function of the superimposed substrate bias. The oxidation depth shows a maximum in a very downstream of further position from the microwave window. The silicon trench oxidation mapping clearly demonstrates that the maximum is brought about along the line of the substrate bias of +20 V just above the plasma potential. In particular, the silicon trench bottom oxidation is just limited onto the higher radio frequency bias within the above condition. It is concluded that the oxidation is due to the negative oxygen ions in downstream.

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