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Damage diffusion model during alcohol-base plasma etching for magnetic materials KEIZO KINOSHITA, KATSUMI SUEMITSU, NORIKAZU OHSHIMA, NOBUYUKI ISHIWATA, TADAHIKO SUGIBAYASHI, NEC Corp. — Methanol plasma etch has been expected to candidate for the next etch process of magnetic materials due to its high etch selectivity to tantalum. However, there exist process induced damage issues [1]. The progression of the damage with changing etch end point was analyzed in this paper. MTJ samples with NiFe/MgO/CoFeB structure were evaluated by hysteresis-loops taken by the MTJ resistance while changing external magnetic field. Resistivity of the MTJ showed fine distributions for every end point samples until CoFeB clear. Redeposited material onto sidewall of the MTJ pattern brought less electrical-short problem. Degradation of the NiFe layer was observed as the MR ratio reduction. Time evolution of effective damage depth from sidewall of the NiFe pattern was estimated from this MR ratio decrease based on the damage diffusion model. The effective damage depth well correlated to the oxygen penetration depth directly observed by TEM-EELS on the sample cross section. Part of this work was supported by JSPS through its FIRST Program (R&D of Ultra-low Power Spintronics-based VLSIs, PI: Hideo Ohno).

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