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STI-CMP 에서 나노 세리아 슬러리에 첨가되는 계면 활성제의 농도, pH, 분자량의 영향

Effect of pH, Molecular Weight, and Concentration of Surfactant in Nano-Ceria Slurry on STI-CMP

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In STI-CMP, ceria slurries with surfactant have high oxide-to-nitride removal selectivity and widen the processing margin in mass production. Hence, controlling the surfactant characteristics is essential for improving the ceria slurry performance in STI-CMP. In this study, we found that for a surfactant with a higher molecular weight, the oxide removal rate markedly decreased as the surfactant concentration increased. But in the case of a lower molecular weight, the removal rate only slightly decreased. The nitride removal rate drastically decreased with decreasing molecular weight at a lower surfactant pH, and it essentially saturated beyond a surfactant concentration of 0.10 wt% for the surfactant with the highest molecular weight. In addition, for an increase in surfactant concentration from 0.1 to 0.3 wt%, the slurries with surfactants having a medium or the lowest molecular weight maintained higher nitride removal rates than did the slurry whose surfactant had the highest molecular weight. Moreover, with increasing surfactant concentration and addition of surfactant with the same molecular weight, the nitride removal rates for all slurries drastically decreased and very quickly saturated at a lower surfactant pH. We have explained this from the point of view of electrokinetic effects as modified of zeta potential between the abrasive particle and the nitride film surface in terms of the electrostatic interaction by surfactant adsorption. And also, we proposed a model for the calculated intrinsic viscosity, based on the surfactant adsorption effect on the film surface with different pH values.