고집적 메모리 소자 개발을 위한 Hf-silicate 게이트 산화막 성장 및 특성 분석

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Hf-silicate films are considered to be the most promising alternative gate dielectrics, due to good thermal stability in direct contact with silicon. Hf-silicate films were grown using the precursor combination of hafnium tert-butoxide [$Hf(OC_4H_9)_4$] and Si-amido complexes [$Si(NR_2)_4$] by metalorganic chemical vapor deposition (MOCVD). MOCVD is a desirable growth method to obtain conformal and uniform thin-films. No additional oxygen source was used in this study. The growth rate and film composition of Hf-silicate films were strongly dependent on the growth temperature. Films grown at temperature above 200°C showed Hf-rich compositions and Hf/(Hf+Si) ratio was increased at higher growth temperature. These results were due to the lower thermal stability of $Hf(OC_4H_9)_4$ compared to Si-amido precursors. Also, we investigated the effects of precursor ligand exchanges on the film properties by comparison with the films grown by using Hf-amido and Si-alkoxide precursors. In this case, Si-rich Hf-silicate films were obtained. The dielectric constants and electrical properties of both films were also compared. For the electrical characterization of Hf-silicate films, capacitance-voltage (C-V) and current-voltage (I-V) measurements were performed.