

## ALCVD를 이용한 Hf-silicate, Ti-silicate 게이트 산화막 성장 및 특성 연구

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Atomic layer chemical vapor deposition (ALCVD) of metal (Hf or Ti) silicate films using a precursor combination of tetrakis-diethylamido-hafnium ( $\text{Hf}(\text{N}(\text{C}_2\text{H}_5)_2)_4$ ), tetrakis-diethylamido-titanium ( $\text{Ti}(\text{N}(\text{C}_2\text{H}_5)_2)_4$ ) and tetra-n-butyl-orthosilicate ( $\text{Si}(\text{O}^n\text{Bu})_4$ ) was studied for high dielectric gate oxides. We investigated the effects of deposition conditions on the film growth ; such as deposition temperature, pulse time of precursor and purge injection. In case of hafnium silicate, the growth rate, composition ratio ( $\text{Hf}/(\text{Hf} + \text{Si})$ ), and ALCVD window were  $1.1 \text{ \AA}/\text{cycle}$ , 0.37 and  $290\text{--}350 \text{ }^\circ\text{C}$ , respectively. A Si-rich composition was observed for the grown Hf-silicate films under our growth conditions. Hf-silicate films deposited at  $300 \text{ }^\circ\text{C}$  were amorphous up to  $900 \text{ }^\circ\text{C}$  and had an averaged dielectric constant of 9.8 with the hysteresis less than 0.18 V in capacitance-voltage (C-V) measurements. In case of titanium silicate, the growth rate, composition ratio ( $\text{Ti}/(\text{Ti} + \text{Si})$ ) and ALCVD window were  $0.8 \text{ \AA}/\text{cycle}$ , 0.60 and  $170\text{--}210 \text{ }^\circ\text{C}$ , respectively. Carbon and nitrogen impurity concentrations were detected a little ( $< 2$  atomic percent). Ti-silicate films deposited at  $200 \text{ }^\circ\text{C}$  were amorphous up to  $600 \text{ }^\circ\text{C}$ .

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