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Highly conformal carbon-doped SiCN films by plasma-enhanced chemical vapor deposition with enhanced barrier properties

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ABSTRACT

A plasma-enhanced chemical vapor deposition (PECVD) was developed for the growth of highly conformal carbon-doped silicon nitride (SiCN) films with enhanced barrier properties drawing on tunable carbon contents, k-values, and wet etch rates (WER). Trisilylamine (TSA) was used as the main precursor and hexane was used as a hydrocarbon-containing additive precursor for carbon doping. At low deposition temperatures ≤400℃, we show that this PECVD process leads to the formation of SiCN films with good conformality of approximately 91% over high aspect ratio trench nanostructures (4.2:1) with a growth rate of ~2.5 (Å/cycle). In particular, the role of TSA and hexane precursors on the film growth mechanism and the k-values, and WER in the composite structures have been explored. The precursors were introduced pulse-wise into the reaction chamber while plasma was excited. The WER of the film was evaluated in a buffered hydrofluoric acid etchant. The k-value and carbon concentration varied depending on the TSA/hexane supply time in the ranges of 7-4.5 and around 6-

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