

# Atomic Layer Deposition of Cyclopentadienyl Based Hf Precursor With Various Oxidants

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## Abstract text :

In electronic devices, a hafnium based oxide film has drawn a lot of attention, because it is a potential high-k material that can replace SiO<sub>2</sub> in a conventional transistor. Recently, hafnium based oxide films can be used for other applications, such as next generation DRAM capacitors and NAND flash memories. HfCl<sub>4</sub> was one of the best precursor candidates for a HfO<sub>2</sub> film, however, there are some issues related to corrosive halide ligands, low vapor pressure, difficulty in delivering a solid precursor. In order to solve those issues, Hf(RCp)(NMe<sub>2</sub>)<sub>3</sub> (R = H, Me), which are chlorine free precursors, were proposed. In this work, these precursors were evaluated for physical properties and ALD processes. Both precursors showed high thermal stability and clean evaporation in TG. Hf(Cp)(NMe<sub>2</sub>)<sub>3</sub> and Hf(MeCp)(NMe<sub>2</sub>)<sub>3</sub> have high vapor pressure (1 Torr at 90 °C) and low viscosity (9 cP at 30 °C). According to ALD evaluation, both precursors obtained high ALD windows up to 360 - 370 °C with a growth rate of 0.9 - 1.0 Å/cycle with ozone and a growth rate of around 0.5 Å/cycle with water. X-ray photoelectron spectroscopy (XPS) showed that deposited thin films were pure, carbon and nitrogen impurities were below the detection limit. Step coverage of the film was excellent (~100%, AR= 1:40) at 360 °C.

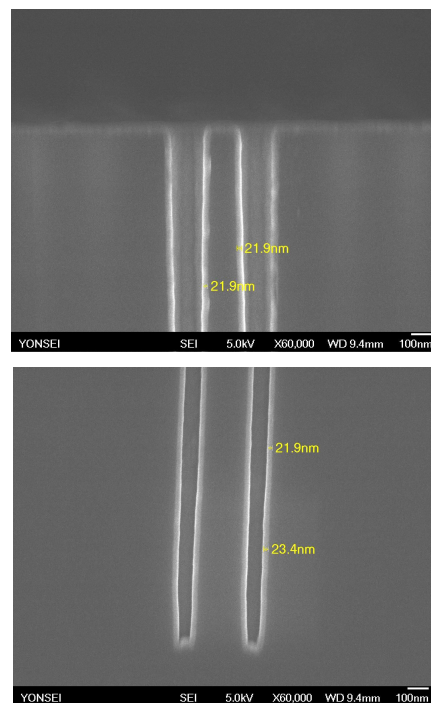


Fig1. Step coverage using Hf(MeCp)(NMe<sub>2</sub>)<sub>3</sub> with ozone