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Preparation of HfO₂ thin films by MOCVD using the novel single precursor, Hf(mp)₄

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Hafnium oxide films were deposited on silicon substrates by metal organic chemical vapor deposition (MOCVD) using the novel single precursor, hafnium 3-methyl-3-pentoxide {Hf[OC(CH₃)(C₂H₅)₂]₄, Hf(mp)₄}, without any oxygen source. Hf(mp)₄ is liquid at room temperature and has a moderate vapor pressure (1.5 Torr at 60 °C) comparable to hafnium t-butoxide, Hf(O^tBu)₄. The deposition rate measured by ellipsometry was found to be about 60 Å/min at the substrate temperature of 400 °C. By GC/MS and NMR analyses of thermally decomposed products collected during the deposition of HfO₂ films, it was found that the HfO₂ films are grown by a β-hydrogen elimination process of the Hf(mp)₄ single precursor. Negligible carbon contamination was detected by XPS and depth-profiling AES. The morphology, crystallinity, and electrical property of the HfO₂ films were characterized by AFM, SEM, and I-V and C-V measurements.