Synthesis of a tin compound bearing N-alkoxy carboxamide and methyl ligands as a precursor for SnO_2 fabrication via atomic layer deposition

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We synthesized a novel tin precursor and deposited SnO_2 thin films to demonstrate their excellent applicability in gas-sensor technology. The novel $SnMe_3$(EDPA) (EDPA, N-ethoxy-2,2-dimethylcarboxylicpropanamide) precursor was analyzed using thermogravimetric analysis (TGA), which revealed complete mass loss at 155 °C with negligible residue. The temperature of $SnMe_3$(EDPA) under 1 Torr vapor pressure was 25 °C. We successfully deposited tin oxide via atomic layer deposition (ALD) using $SnMe_3$(EDPA) and O_2 plasma as reactants. The film growth behavior of SnO_2 thin films deposited via the ALD process exhibited typical surface-limited reaction characteristics and a crystal structure of tetragonal tin dioxide. The films had an optical bandgap of 3.5–3.6 eV and a refractive index of ~1.9, which is a typical optical property of SnO_2. Further, we confirmed that there were almost no impurities and that it was an n-type material. Consequently, our experimental results showed that the SnMe3(EDPA) precursor is suitable for the ALD process. The chemical sensing experiments demonstrated the superiority of films deposited using the novel precursor, which significantly exceeded the performances reported in previous studies.