Atomic Layer Chemical Vapor Deposition of Hf-silicate Gate Dielectrics for Organic Thin Film Transistor Application

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Atomic layer chemical vapor deposition (ALCVD) process of hafnium silicate thin films was studied for organic thin film transistor application. A precursor combination of tetrakis-ethylmethylamido-hafnium ($Hf(N(CH_3)(C_2H_5))_4$) and tetra-n-butyl-orthosilicate ($Si(O^nBu)_4$) was used without additional reactant gases. Each precursor shows self limiting surface reaction characteristics and the ALCVD temperature window was below 330 ℃ with a remarkably high growth rate of 2.3 Å/cycle. We also investigate the characteristics of organic thin film transistor (OTFT) using the hafnium silicate film as a dielectric layer. To observe the performance improvements, ALCVD grown Al_2O_3 and thermally grown SiO_2 were used to fabricate OTFT devices as well. The hafnium silicate OTFT shows 3 times and 5 times higher mobility compare to the Al_2O_3 OTFT and SiO_2 OTFT, respectively. In this study, we show the promising possibility of the applications of high-k materials to the high mobility and low operation voltage OTFT devices.