

Fabrication of Organic–Inorganic Nano Hybrid Superlattice Thin Films by Molecular Layer Deposition

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Nano hybrid superlattices consisting of organic and inorganic components have great potential for creation of new types of functional material by utilizing the wide variety of properties which differ from their constituents. They provide the opportunity for developing new materials with new useful properties.

Herein, we fabricated new type of organic-inorganic nano hybrid superlattice thin films by a sequential, self-limiting surface chemistry process known as molecular layer deposition (MLD) combined with atomic layer deposition (ALD). An organic layer was formed at 150°C using MLD with repeated sequential adsorption of Hydroquinone and Titanium tetrachloride. A TiO₂ inorganic nanolayer was deposited at the same temperature using ALD with alternating surface-saturating reactions of Titanium tetrachloride and water. Using UV-Vis spectroscopy, we confirmed visible light absorption by LMCT. And FTIR spectroscopy and XPS were employed to determine the chemical composition. Ellipsometry and TEM analysis were also used to confirm linear growth of the film versus number of MLD cycles at all same temperature. In addition, p-n junction diodes demonstrated in this study suggest that the film can be suitable for n-type semiconductors.

Keywords: Nano hybrid, superlattice, thin film, atomic layer deposition, molecular layer deposition, diode