

## High performance moisture barrier comprised of self-aligned organic-inorganic hybrid layer and ALD Al<sub>2</sub>O<sub>3</sub> for thin-film encapsulation of OLEDs

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Flexible Organic Light Emitting Diodes (OLEDs) have been recently considered to be the most promising device for next-generation displays. One of main issues for flexible OLEDs is reliable and/or robust Thin Film Encapsulation (TFE) technique such as materials, processes, and structures. Over the past few years, many researchers have studied TFE using Atomic Layer Deposition (ALD) Al<sub>2</sub>O<sub>3</sub> due to its superior barrier properties. However, although the ALD Al<sub>2</sub>O<sub>3</sub> film has an excellent barrier property, a single layer Al<sub>2</sub>O<sub>3</sub> is not enough for the basic requirements of water vapor transmittance rate (WVTR) and mechanical flexibility. In order to improve gas barrier properties and flexibility, several previous studies of organic/inorganic hybrid structure for TFE have been investigated with various techniques (ALD, CVD, Sol-Gel, and PVD) since Vitex organic/inorganic structure was announced in 2003. Even though organic/inorganic structure is effective for improving gas barrier properties and flexibility, it has never achieved for ultimate requirements (Bending radius < 1mm and WVTR < 10<sup>-6</sup>g/m<sup>2</sup>day).

In this study, we investigated a multi-barrier for encapsulation of OLEDs using self-aligned organic-inorganic hybrid layer by solution process and Al<sub>2</sub>O<sub>3</sub> by ALD, which would suggest a possible approach to achieve highly flexible and high diffusion barrier property. As a result, the suggested hybrid layer exhibited better WVTR of 1.08 × 10<sup>-4</sup> g/m<sup>2</sup>day at 85°C/85%R.H than that (2.69 × 10<sup>-4</sup> g/m<sup>2</sup>day) of single Al<sub>2</sub>O<sub>3</sub>. This presentation will be discussed with each film property, using Ca-test, contact angle measurement, AFM, SEM, and TEM.

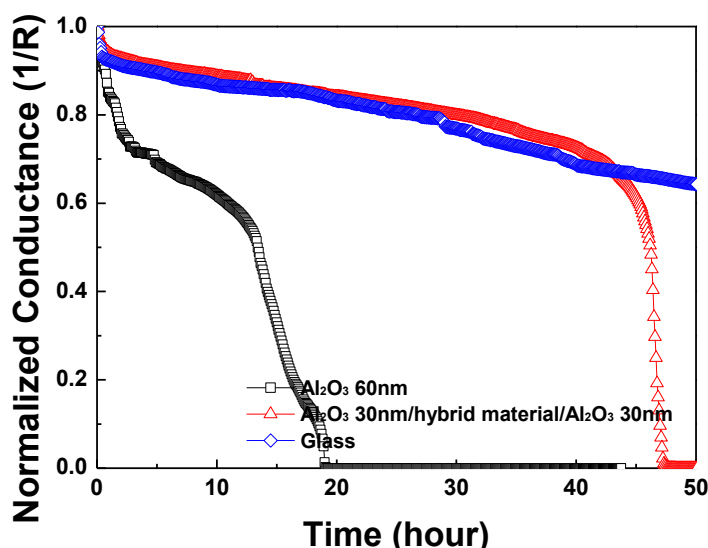


Fig. 1. Representative Ca-test results of single ALD Al<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>/hybrid materials/Al<sub>2</sub>O<sub>3</sub> and Glass

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