

Transparent Multi-layer Barrier to Prevent Moisture Permeation Using Al₂O₃ Hybrid Process

Soon-Hyung Kwon, Hyun Gyu Jang, Won Keun Kim

Display Materials & Components Research Center, Korea Electronics Technology Institute
Seongnam, Gyeonggi-do, Republic of Korea
kwonsh@keti.re.kr

Extended Abstract

Hybrid type multi-layer barrier technology using solution process with atomic layer deposition (ALD) is an attractive technology that can form a water permeation barrier for electronic paper panel with a low cost and a high speed process¹. This barrier formation technology using alumina solution needs to overcome the problem of pinhole generation due to particle non-uniformity and inorganic oxide thin film defect². The Al₂O₃ ALD process was carried out after the solution process to improve the pin hole suppression technique³. The solution process film was prepared by spin coating the material synthesized for 6 hours at 75 ° C and 750 rpm using 0.75g of aluminium nitride nonahydrate (Acros Organics, 99.999%) and 4.82g of 2-methoxyethanol solvent (Sigma Aldrich) on polyarylate substrate (PAR, A200HC Ferrania Technologies Company, Italy). In this paper, we focus on the optimization study of molar concentration condition of alumina (Al₂O₃) solution for multi-layer structure. Alumina solution samples of various molar concentration (1.2 mol, 1.6 mol and 2.0 mol) were coated on the PAR film and then were irradiated by UV to obtain the dense inorganic film. In particular, 1.2 mol sample showed no yellowing phenomenon and thus had excellent optical characteristics. In the alumina solution process, the density of the structure may be improved according to the molar concentration, but the possibility of the pinhole is very high. So hybrid process is necessary to overcome this. In the case of ALD process, since the deposition is performed on the atomic unit, the pin hole can be suppressed. In our experiment, ALD process which can improve the barrier property was performed in the thickness of 30 nm. Our final water permeation prevention barrier is consist of a solution process film and an ALD process film of total thickness of 80 nm. The fabricated hybrid barrier was measured for water vapour transmission rates (WVTR) using MOCON AQUATRAN equipment. The results showed 7.5×10^{-2} g/m²/day.

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