PW-P003

Al_2O_3 High Dense Single Layer Gas Barrier by Neutral Beam Assisted Sputtering (NBAS) Process

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Recently, the growing interest in organic microelectronic devices including OLEDs has led to an increasing amount of research into their many potential applications in the area of flexible electronic devices based on plastic substrates. However, these organic devices require a gas barrier coating to prevent the permeation of water and oxygen because organic materials are highly susceptible to water and oxygen. In particular, high efficiency OLEDs require an extremely low water vapor transition rate (WVTR) of $1\times10^{-6}g/m^2day$. The Key factor in high quality inorganic gas barrier formation for achieving the very low WVTR required ($1\times10^{-6}g/m^2day$) is the suppression of defect sites and gas diffusion pathways between grain boundaries. In this study NBAS process was introduced to deposit enhanced film density single gas barrier layer with a low WVTR.

Fig. 1. shows a schematic illustration of the NBAS apparatus. The NBAS process was used for the Al_2O_3 nano-crystal structure films deposition, as shown in Fig. 1. The NBAS system is based on the conventional RF magnetron sputtering and it has the electron cyclotron resonance (ECR) plasma source and metal reflector. Ar^+ ion in the ECR plasma can be accelerated into the plasma sheath between the plasma and metal reflector, which are then neutralized mainly by Auger neutralization. The neutral beam energy is controlled by the metal reflector bias. The controllable neutral beam energy can continuously change crystalline structures from an amorphous phase to nanocrystal phase of various grain sizes. The Al_2O_3 films can be high film density by controllable Auger neutral beam energy. we developed Al_2O_3 high dense barrier layer using NBAS process. We can verified that NBAS process effect can lead to formation of high density nano-crystal structure barrier layer. As a result, Fig. 2. shows that the NBAS processed Al_2O_3 high dense barrier layer shows excellent WVTR property as a under 2×10-5g/m^2day in the single barrier layer of 100nm thickness. Therefore, the NBAS processed Al_2O_3 high dense barrier layer is very suitable in the high efficiency OLED application.

Keywords: gas barrier, WVTR, Al_2O_3

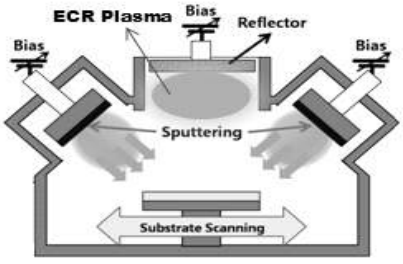

Fig. 1. Schematic illustration of the NBAS

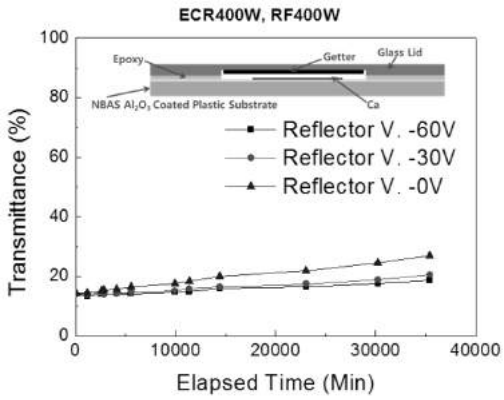

Fig. 2. Ca test (50°C, 90%RH) and cross section of Ca test cell