Investigation of Thickness Dependence of Surface Potential of Evaporated Mixed Films of TPBi and CBP

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Organic light emitting devices have been extensively investigated in many promising applications. Surface potential (SP) is essential in characterizing the fabrication process of Organic light emitting diodes (OLEDs). In the case of OLED fabrication, some organic materials are spontaneously oriented and ordered in the evaporation films in the OLED structure. Although, according to the literature, many organic semiconductor films show such a spontaneous orientation polarization (SOP), the formation mechanism of SOP has not been well understood. Thus, far many studies have been dedicated to understand macroscopic properties of SOP in the single component. However they have not been well characterized in terms of SOP for mixed films which are often used in the OLEDs. Thus, it is essential to characterise the surface potential and its local distribution on mixed films of polar and nonpolar molecules which are commonly employed in OLED fabrication. As the initial step, we have characterized TPBi (polar) - 2,2',2"- (1,3,5-Benzinetriyl)-tris(1-phenyl-1-H-benzimidazole) with CBP (nonpolar) - 4,4′-Bis(N-carbazolyl) - 1,1′-biphenyl via the Kelvin probe (KP) measurement technique in order to verify the surface potential.Organic layers were deposited on half covered (using shadow mask) Indium Tin Oxide (ITO) glass substrate *via* the vacuum evaporation technique at UHV chamber with a base pressure of ~ 10^{-4} Pa in the dark condition. After carefully adjusting the evaporation condition of each molecule using thickness monitor, two molecules were simultaneously deposited on the ITO substrate. Several mixed films with different thicknesses were fabricated under the same experimental conditions in order to identify the surface potential as a function of mixed film thickness. KP measurement was performed for each film and after the KP measurement, thickness of the films was estimated *via* profilemeter and atomic force microscope measurements. The results of the surface potential against film thickness were obtained for each and every film. It is clear from the results that the surface potential of TPBi (polar) with CBP (nonpolar) mixed film increases with the increment of film thicknesses which implies that the molecular interactions decrease with the increment of film thickness. Further, we have compared the SP of mixed film with single film of TPBi and found the values to be 74.75 mV/nm and 57.53 mV/nm for the mixed and the single films, respectively.

Keywords: kelvin probe, organic light emitting diode, spontaneous orientation polarization, surface potential