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Observation of surface potential on evaporated mixed films of TPBi with CBP as function of the film thickness

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Organic light emitting devices have been extensively investigated for many promising applications. Surface Potential (SP) is essential to characterize the fabrication process of Organic Light Emitting Diode (OLED). In the case of OLED fabrication, some organic materials are spontaneously oriented and ordered in the evaporation films in OLED structure. According to the literature, many of organic semiconductor films show such a spontaneous orientation polarization (SOP) however, 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 there has 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 employing 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* Kelvin Probe (KP) measurement technique in order to verify the surface potential. Organic layers were deposited to half covering (using shadow mask) Indium Tin Oxide (ITO) glass substrate *via* vacuum evaporation technique at UHV chamber with a base pressure of $\sim 10^{-4}$ 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 in the same experiment conditions in order to identify the surface potential as the function of mixed film thickness. KP measurement were performed for each films and after the KP measurement, thickness of the films were estimated *via* profilemeter and atomic force microscope measurements. The results of surface potential against film thickness were obtained for each and every films. It is clear from the results as the surface potential of TPBi (polar) with CBP (nonpolar) mixed film increases with the increment of film thicknesses which implies the molecular interactions increase with the increment of film thickness. Further, we have compared the SP of mixed film with single film of TPBi and found that the values of 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