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Annealing Effect of Gravure Printed Organic Light Emitting Layer formed by PVK and $Ir(ppy)_3$

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Organic light emitting layer in OLED device was formed by gravure printing process in this work. Organic surface coated by gravure printing typically showed relatively bad uniformity. Thickness and roughness control was characterized by applying various solvents in this work. [Solvent dependence on surface roughness was investigated in this work.]

The device layer structure of the OLED device is as follow :. glass/ITO/PEDOT:PSS/PVK+Ir (ppy)3-active layer/LiF/Al.. PVK(Poly (N-vinyl carbazole)) and $Ir(ppy)_3$ was used as the active light emitting material. PVK was used as a host and $Ir(ppy)_3$ as green-emitting dopant. The mixture of PVK and $Ir(ppy)_3$ material was printed by gravure printing technology for polymer light emitting diode (PLED). To control the thickness multi-printing technique was applied up to 4 times. As the number of the printing was increased the thickness enhancement was increased and roughness was reduced. To control the roughness of organic layer film, thermal annealing process was applied. The annealing temperature was varied from room temperature, 80℃, 130℃ , to 180℃. As the annealing temperature was increased, both the thickness and roughness was reduced. Different solvents showed variation of roughness. chlorobenzene, 1,2- dichlorobenzene (DCB) and chloroform were compared for their impact on the surface roughness. DCB showed the best roughness. The low evaporation rate of the DCB is believed to improve the surface roughness. We have also investigated the effect of the roll rotation speed. The rotation speed was varied to 23, 40, 62, and 83 rpm. In case of chloroform, the thickness was inversely proportional to the roll rotation speed because of high evaporation rate of chloroform. In case of DCB, the thickness was proportional to the roll rotation speed. When the evaporation is low, the higher rolling speed was preferred for the thicker layer formation.