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Multilayer White Organic Light Emitting Diode by Gravure Printing

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WOLEDs (Whithe organic emitting diode) are widely studied for not just large area and high-definition for display, but for lighting applications such as back-light of LCDs. WOLED is being considered as low-cost displays and lighting devices in market. Various printing processes are considered as large area processing technology for WOLEDs. Among them, gravure printing has been being popularly used in mass-produced printing, and this printing technology has various merits of low processing temperature, low manufacturing cost, high processing speed, and roll-to-roll production capability. However, it is challenging to form nano-scale thick organic layers with gravure printing.

In this work, we have investigated various materials and stack structures with gravure printing processes. In fabrication of gravure printed OLED, we use optimized mix-solvent for below 100nm and uniformed surface. White lighting is typically realized by combining three primary RGB colors or two colors of yellow and blue. In this study, we investigated that gravure printed WOLED by using the Ir metal complex doped materials and blue fluorescent material in single and multi-layer structures. For white emission, we used bis(1-phenylisoquinoline) (acetylacetonate) iridium(III) (Ir(piq)2) as a red emitter and (tris-(2-phenylpyridine)iridium(II)(Ir(ppy)3) as a green emitter and bis(4,6-difluorophenylpyridinato-N,C2) picolinatoiridium (FIrpic) as a blue emitter. And we used 4,4'-Bis(2,2-diphenyl -ethen-1-yl)biphenyl (DPVBI) as a blue fluorescent material.

Multi-layer structure showed higher efficiency than single mixed layer structures and DPVBI helped in making color index (CIE) close to ideal white in both single and multi-layer structures.