Multiple patterned electrodes for utilizing versatile surface plasmon resonance in organic optoelectronic devices

이윤호[1], 오준학[1,2,†]
[1]포스텍; [2]포스텍 화학공학과
(joonhoh@postech.ac.kr†)

Surface plasmons by introduction of plasmonic structure are a viable way for improving the performance of optoelectronic devices. Here, by employing block-copolymer and nano-imprinting lithography, we demonstrate a highly effective multiple patterns of polystyrene, eventually for making a multiple pattern of metal electrodes as back reflectors to fabricate solution-processable organic optoelectronics. The surface plasmon effects of metal electrodes as back reflectors allow significant additional light absorption compared with metal electrodes without the multiple patterns, leading to remarkable enhancements of power conversion efficiency of 13.8% in organic photovoltaics and external quantum efficiency enhancement of 20.4% in organic photodiodes as well as external quantum efficiency enhancement of 637.7% in organic phototransistors. Theoretical study and near-field scanning optical microscopy revealed strong surface plasmon coupling of these nanostructured electrodes. These results demonstrate that the multiple patterns constitute a versatile and effective route for achieving high-performance organic optoelectronics.