Ultrafast laser processing and engineering of material properties for more efficient organic electronics

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Organic electronics have drawn many attentions for tomorrow's smart devices because of their thin, light and flexible forms. Such organic devices can be applied in ICT, energy, and healthcare as wearable devices. In South Korea, huge efforts are being paid in manufacturing of OPVs, OLED displays, and various stretchable sensors. Benefits of organic electronics such as variety of materials, high tunability of material properties, and cost-effective manufacturing process enable customizable flexible electronics. However, industrialization of these organic electronics remains still challenging due to their low quantum efficiency, degradation of organic active materials by oxidation and humidity as well as the need of novel low temperature manufacturing process.

This talk will present our recent research work in ultrafast laser processing involving organic conducting polymer blend film[1-3], and transparent conductive electrode patterning[4,5]. First, engineering of the electrical properties in organic conducting thin film is presented. Laser induced photo-expansion and molecular reorientation, tailoring of surface structure is investigated as a new pathway to increase the quantum efficiency of OPVs. Second, selective laser patterning of electrodes composed of composite flexible light extracting polymer materials is also demonstrated to suggest a laser based continuous manufacturing scheme. These proposed processes are promising for customizable and efficient organic device fabrication, especially for high quantum yield OPVs and OLED lightings.

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