Flexible OLED display one-step closer with organic light emitting material direct writing

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(PhysOrg.com) -- One of the more interesting methods of pattern transfer available for a number of applications right now is Laser Induced Forward Transfer (LIFT). However, when working with organic material, there are some drawbacks to LIFT, as well as other drawbacks to making use of a high threshold UV or IR laser to effect the transfer. "Besides thermal degradation," Seung Hwan Ko tells *PhysOrg.com*, "high laser threshold laser can also induce mechanical cracks on transfer material and problems in edge sharpness."

Ko works at the University of California, Berkeley. Along with Heng Pan, Sang Ryu, Nipun Misra and Costas Grigoropoulos at Berkeley, and Hee Park at AppliFlex in Mountain View, California, Ko believes that a solution may have been found. The team created a LIFT-based process called Nanomaterial Enabled Laser Transfer (NELT) in order to create direct patterning process resulting in a high resolution while transferring the organic light emitting diode (OLED) without damage. Their work is described in *Applied Physics Letters*: "Nanomaterial enabled laser transfer for organic light emitting material direct writing."

"NELT process can be used for any kinds of heat sensitive organic material direct patterning and transfer," Ko explains. "NELT process can achieve more versatile laser wavelength selection with one or two order smaller laser energy than conventional LIFT processes by introducing a specially engineered nanoparticle layer as a laser absorbing and dynamic release layer." Organic material is delicate, and can be easily damaged by intense heat from lasers. This is what makes the LIFT process, which relies on high temperatures for the proper pressure for transfer, of dubious worth in terms of advancing OLED technology.

The nanoparticle layer is what mainly absorbs the laser wavelength. Because of its weak interaction with the organic material, there is less potential for damage. “[N]anomaterials exhibit remarkable properties that may be substantially different from those observed in the bulk counterparts,” Ko says. He also points out that the NELT process uses less energy than the LIFT processes currently considered conventional for direct writing.

Among the more interesting applications for the NELT process is the possibility of flexible displays. “Flexible displays are built on flexible substrates so that they can be bent or folded just like a paper. They are futuristic displays usually found in the sci-fi movies.” Ko then continues with additional possible applications for this work: “Other applications include very large area organic light emitting diode display, active material transfer such as semiconducting polymer for organic field effect transfer for organic electronics, and biological material direct transfer for bio-sensor application.”

Even with this advance, however, more is required, especially in terms of flexible display. Ko says that a transistor is needed in addition to the light-emitting portion of the display. “Currently we have successfully demonstrated a light emitting diode material direct patterning and transfer by NELT process and several direct writing methods for organic field effect transistor arrays on a polymer substrate. Now we plan to develop a novel approach to integrate organic light emitting diode and organic field effect transistor to demonstrate a working flexible display.”

Science fiction may be moving a little closer to becoming science fact.

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emitting material direct writing, Seung H. Ko, Heng Pan, Sang G. Ryu, Nipun Misra, Costas P. Grigoropoulos, and Hee K. Park, *Applied Physics Letters* online publication 15/10/2008.
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