Tunable surface plasmon-polariton resonance in organic light-emitting devices based on corrugated alloy electrodes

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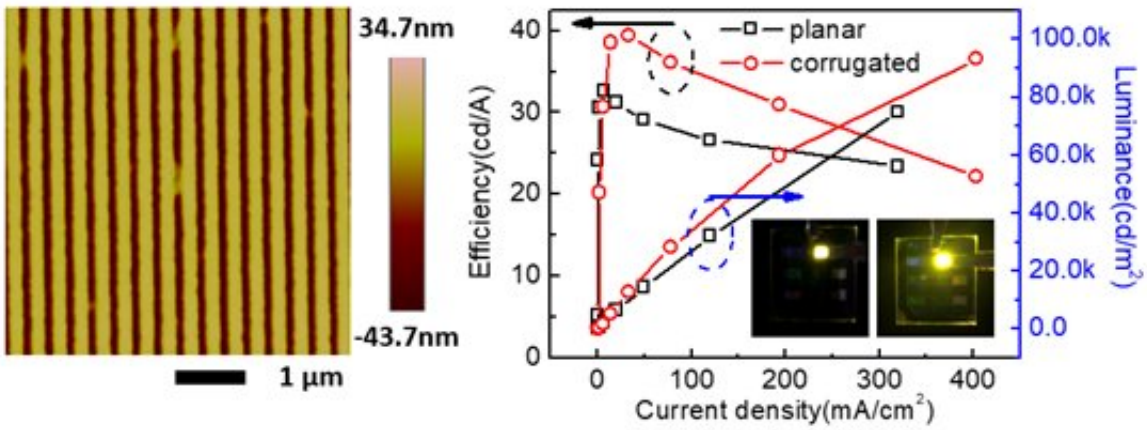

Tunable SPP resonance in OLEDs based on corrugated alloy electrodes. Credit: Compuscript Ltd

In a new publication from *Opto-Electronic Advances*, researchers led by Professor Yan-Gang Bi from Jilin University, Changchun, China discuss tunable surface plasmon-polariton resonance in organic light-emitting devices based on corrugated alloy electrodes.

Organic light-emitting devices (OLEDs) have a wide range of selections of materials, broadband spectra, high brightness, low thickness, wide viewing angle and excellent transparency and flexibility. Consequently

they have become a focus of research interest and have demonstrated potential application in flexible and stretchable equipment. Nearly 100% of the internal quantum efficiency has been achieved in phosphorescent OLEDs, however, a great number of photons generated in active layers are trapped and lost in OLEDs. The power loss in OLEDs is derived from the substrate mode, waveguide mode, surface plasmon-polariton (SPP) mode etc. Periodic corrugations are used to excite SPP resonance, and corrugated metal electrodes can extract the photons trapped by SPP mode in OLEDs. The period of corrugations is a key factor to excite SPP resonance at the desired light-emitting wavelength in various OLEDs. Two-beam interference lithography, nanoimprint lithography (NIL), electron beam lithography, and focused ion beam lithography are common technologies to fabricate periodic corrugations. However, the complex fabrication process with high cost makes them difficult in commercial applications to obtain corrugations with different periods in various OLEDs.

The wavelength of excited SPP resonance can also be modified by material properties of the metal/dielectric interface. In this article the authors report a feasible method to realize tunable SPP resonance in OLEDs by employing corrugated Ag-Al alloy electrodes. The excited SPP resonance induced by the periodic corrugations was precisely tuned based on the composition ratios of the Ag-Al alloy electrodes. With an appropriate composition ratio of the corrugated alloy electrode, the photons trapped in SPP modes were recovered and extracted effectively. The 25% increasement in luminance and 21% enhancement in current efficiency were achieved by using the corrugated Ag-Al alloy electrodes in OLEDs.

More information: Xue-Mei Wen et al, Tunable surface plasmon-polariton resonance in organic light-emitting devices based on corrugated alloy electrodes, *Opto-Electronic Advances* (2021). DOI: 10.29026/oea.2021.200024