FOLED with enhanced external efficiency using corrugated Ag anode

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Flexible Organic light emitting devices (FOLEDs) are attracting more and more attention because of their potential applications in general lighting and flat panel displays. Although some problems that once disturb the application of light extraction technology, such as wavelength dependency and viewing angle dependency, have been partially solved in recent progress, the complicated and expensive fabrication process of these approaches is still not suitable for the real applications. In this paper, we present a simple method to fabricate Ag anode with nano-scaled corrugations on polycarbonate (PC) flexible substrate. The template of quasi-period corrugated structured is directly fabricated on silica substrate through reactive ion etching, using silica particles as etching mask. Then the structures are transferred to plastic substrate by thermal nano-imprint lithography (NIL).

Compared with the control devices (ITO device and planar Ag device), the FOLED fabricated on corrugated Ag anode exhibits high efficiency, broad spectra and Lambertian angular emission, as shown in Figure 2 and Figure 3. Furthermore, because of the quasi-periodical structures on Ag anode, the corrugated microcavity is formed, problems such as wavelength dependency and viewing angle dependency that once disturbed the application of traditional planar microcavity OLEDs, can be solved effectively, as shown in Figure 3. Meanwhile, since the mechanical properties of Ag is better than traditional ITO anode, the conductivities of flexible substrates with both planar and corrugated Ag anode layers can be well maintained after bending tests, as shown in Figure 4.

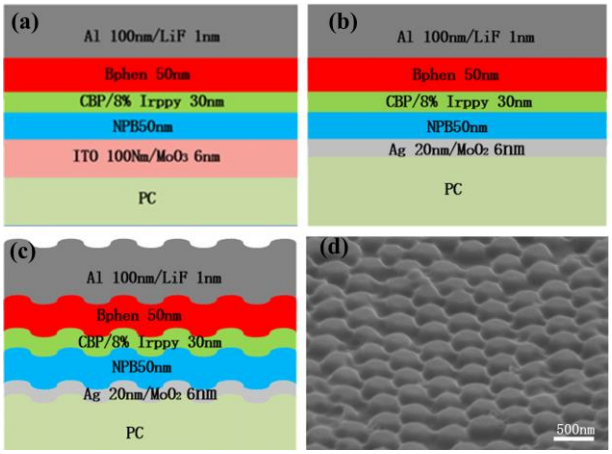

Figure 1. Structures for devices of (a) ITO anode (b) planar Ag anode and (c) corrugated Ag anode;(d) SEM image of corrugations on PC substrate through

thermal NIL.

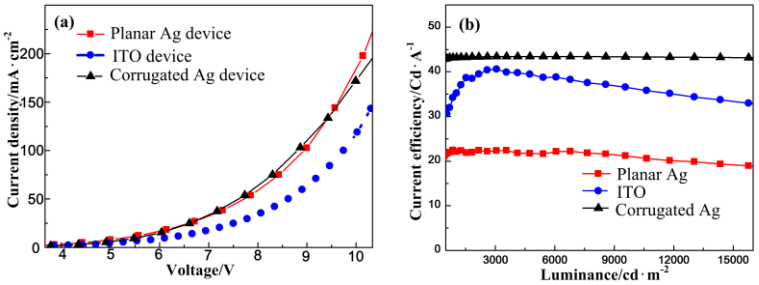

Figure 2: (a) Current density-voltage and (b) current efficiency- luminance characteristics for FOLEDs.

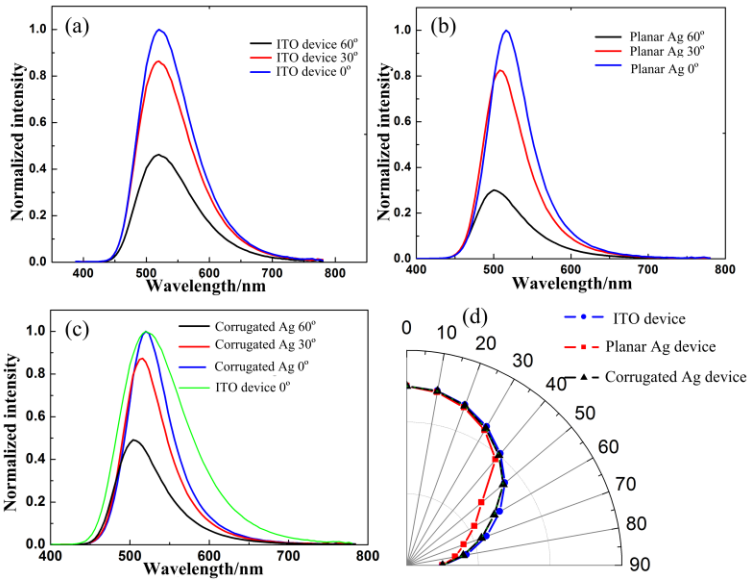

Figure 3: The normalized electroluminescence spectra of (a) ITO device, (b)Planar Ag device and (c) corrugated Ag device;(d) emission patterns of devices.

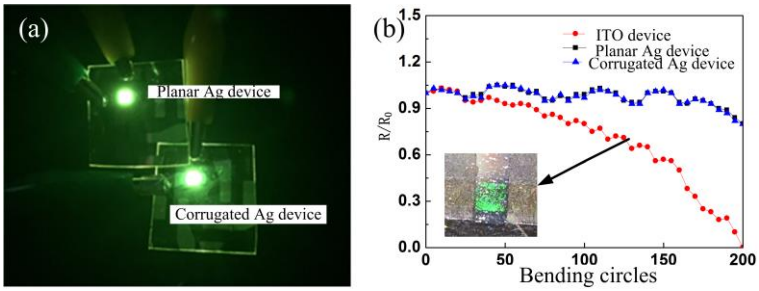

Figure 4: (a) Working FOLEDs on planar and corrugated Ag substrates; (b) resistance properties for substrates after bending test.