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Abstract
An anode of an organic light emitting diode (OLED) requires (1) good electric conduction, (2) good chemical stability and surface roughness, (3) good optical transmittance and (4) high work function. Two kinds of materials have been generally used for the OLED anode: transparent conductive oxides (ITO, ZnO and AZO...) and metals with high work function (Ni, Au and Pt). Although metals are highly electric conductive, they are basically opaque unless their thickness is less than 15 nm. In this study, both ITO and Ni are employed as anode materials of an OLED device.
The fabrication of ITO transparent conductive film has been a mature technology and practically employed for flat panel display industry. However, several ITO film properties need to be improved for flexible OLED applications, such as the ITO surface work function and roughness. This project tends to modulate the ITO surface work function by embedding Ni dots on the ITO film with the use of a polishing approach, the ITO surface roughness can be improved simultaneously.
The fabrication of the Ni embedded ITO anodes was conducted using photolithography and chemical etching to form dot-trenches on ITO surface. The depths of the trenches are 5, 10 and 15 nm, and Ni films with corresponding thickness were deposited onto the trenches. The Ni-embedded ITO anodes were obtained after lifting off the photoresist. The mechanical polishing was followed to improve the surface roughness.
Sheet resistivity, optical transmittance and surface roughness of the Ni-embedded ITO film were measured. Results show the sheet resistivity and surface roughness were improved, whereas the optical transmittance was slightly deteriorated. OLED devices were fabricated on the basis of Ni-embedded ITO films to study the effect of the thickness of Ni metal on the OLED characteristics. Results reveal that an ITO anode with an embedded dot-Ni of 10 nm can derive better OLED characteristics. The mechanical polishing can reduces the surface roughness of both ITO and Ni films, which would help OLED devices to increase their lifetimes. However, prolonged polishing of the Ni-embedded ITO anode deteriorates the I–V characteristics. We conclude that the mechanical polishing with a proper time is an effective approach for an OLED with a Ni-embedded ITO anode to enhance its performances.
Advisory Committee Ching-Ming Hsu - advisor

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