ITO Modification for More Efficient Hole Injection in Organic Light Emitting Diodes

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Abstract

Indium Tin Oxide is the most commonly used anode electrode in organic light emitting diodes (OLEDs). A critical parameter for charge injection is its workfunction, varies between 4.5 and 5.1 eV, depending on the sample preparation and cleaning procedure. These large variations in the workfunction translate to even larger variations in the injected current, which is a major issue for the fabrication of efficient OLEDs. We demonstrate a way to treat ITO and get a contact with good injection characteristics, regardless of the ITO preparation procedure. We have carried out direct measurements of the injection efficiency at the ITO/TPD contact (TPD is N-N'-diphenyl-N-N'-bis(3-methylphenyl)-1-1-biphenyl-4,4'-diamine, a commonly used hole transport layer). The contact is found to be current-limiting, supplying TPD only with 1% of the space charge limited current. By introducing a thin layer of polyaniline, or a thin film of a high work function metal, the injection efficiency approaches 100%, i.e. the contact becomes Ohmic. The performance of the contact shows little sensitivity to the details of the ITO preparation. A mechanism for this improvement is proposed. The change in the characteristics of TDP-based OLEDs are discussed.

Biography

George Malliaras studied physics at the Aristotle University (Greece) and did his doctoral research in the University of Groningen (the Netherlands). He spent two years at the IBM Almaden Research Center before joining the Department of Materials Science and Engineering at Cornell. His research focuses on the design, fabrication, characterization and computer modeling of organic optoelectronic devices.