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Insertion of an Organic Hole Injection Layer for Inverted Organic Light-Emitting Devices

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Recent technical advances in OLEDs (organic light emitting devices) requires more and more the improvement in low operation voltage, long lifetime, and high luminance efficiency. Inverted top emission OLEDs (ITOLED) appeared to overcome these problems. This evolved to operate better luminance efficiency from conventional OLEDs. First, it has large open area so to be brighter than conventional OLEDs. Also easy integration is possible with Si-based driving circuits for active matrix OLED. But, a proper buffer layer for carrier injection is needed in order to get a good performance. The buffer layer protects underlying organic materials against destructive particles during the electrode deposition and improves their charge transport efficiency by reducing the charge injection barrier. Hexaazatriphenylene-hexacarbonitrile (HAT-CN), a discoid organic molecule, has been used successfully in tandem OLEDs due to its high workfunction more than 6.1 eV. And it has the lowest unoccupied molecular orbital (LUMO) level near to Fermi level. So it plays like a strong electron acceptor. In this experiment, we measured energy level alignment and hole current density on inverted OLED structures for hole injection. The normal film structure of Al/NPB/ITO showed bad characteristics while the HAT-CN insertion between Al and NPB greatly improved hole current density. The behavior can be explained by charge generation at the HAT-CN/NPB interface and gap state formation at Al/HAT-CN interface, respectively. This result indicates that a proper organic buffer layer can be successfully utilized to enhance hole injection efficiency even with low work function Al anode.