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CARRIER TRANSPORT IN ORGANIC SEMICONDUCTORS AND THE EFFECT ON THE ELECTROLUMINESCENCE EFFICIENCY

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In order to enhance the electroluminescence (EL) efficiency of organic light-emitting diodes (OLEDs) it necessary to optimize the device structure so that efficient carrier injection at the electrode interfaces and the electron-hole balance in the emitting layer can be achieved. Charge carrier transport is one of crucial parameters that affect the injection and balance of electrons and holes. Therefore, it is very important to understand the charge transport mechanism in organic thin films and elucidate the correlation between the carrier mobility and the electroluminescence (EL) efficiency of OLEDs. We studied the hole mobility of molecularly doped hole transport layer (HTL), 4,4'-bis[N-(1-napthyl)-N-phenyl-amino]-biphenyl (a-NPD), as a function of the doping concentration of various dopants such as 5,6,11,12-tetraphenylnaphthacene (rubrene) and 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (BCP) by employing the time-of-flight photoconductivity (TOF-PC) technique. We characterized the current-voltage-luminance dependence and the EL quantum efficiency for the devices of ITO/doped HTL/Alq3/LiF/Al. Compared with the EL efficiency of the device with undoped HTL, the devices with the doped HTL show higher EL efficiency, which is due to the balance of hole and electron concentrations in the emitting layer.