

Impedance of Carrier Injection at the Metal-Organic Interface Mediated by Surface States

G. Garcia-Belmonte

J. Bisquert

Dept. de Física, Universitat Jaume I, Av. V. Sos Baynat s/n, Spain

The injection properties of metal-organic interfaces are believed to depend on the properties of a thin organic layer contacting the metal. Presence of states within the band gap, due to either a large density of bulk impurities, or interfacial states, will tend to reduce the ability of the organic semiconductor Fermi level to move. The Schottky-Mott limit (absence of interfacial states), which permits the Fermi level to move freely within the gap, is rarely observed in real metal-organic interfaces. A detailed model for the impedance of the injection process is provided that highlights the role of the filling/releasing kinetics of energetically distributed interface states. This approach connects the whole capacitance spectra to the evolution in the occupancy of interface states with bias, with no additional information about bulk trap levels [*Chemical Physics Letters* 422 (2006) 184]. Simulations based on the model allow to derive the density of interface states effectively intervening in the carrier injection. When nonohmic contacts govern the charge injection process, impedance spectroscopy becomes then an important, complementary source of information. Experimental capacitance response along with J - V characteristics are interpreted in terms of the injection of electrons mediated by surface states at the metal-organic interface. Simulations have been confronted with experimental data from thin Alq₃ electron-only devices [*Chemical Physics Letters* 455 (2008) 242], and PPV-based OLED structures [*Physical Review B* 75 (2007) 085316]. The analysis reveals the crucial role of the electronic kinetic processes in interpreting injection-limited currents.

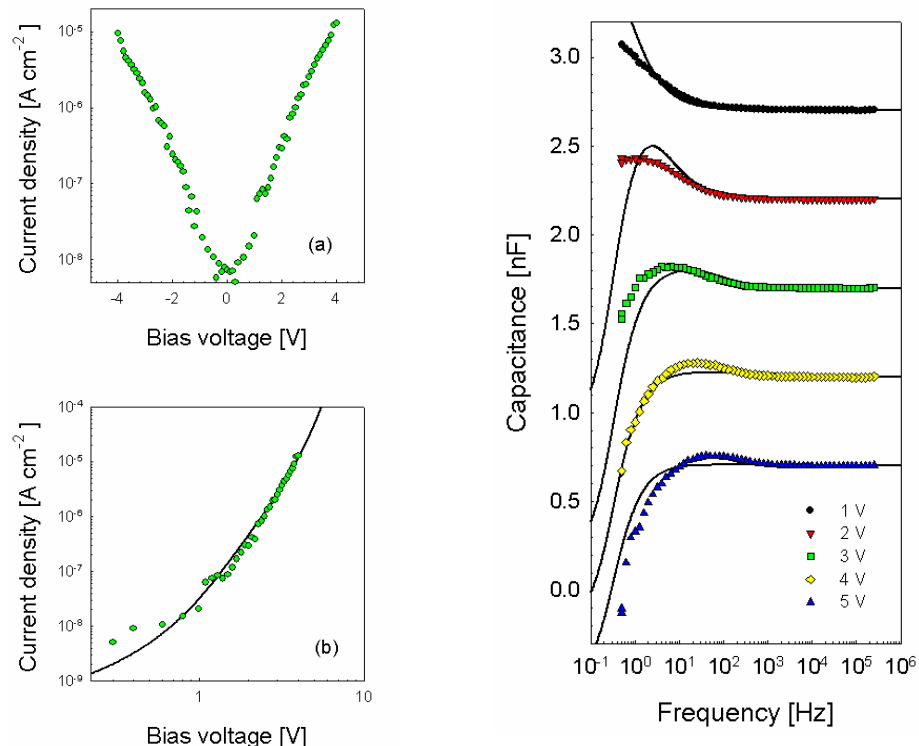


Fig. 1 Experimental data and simulation results (J - V characteristics and capacitance spectra) of Alq₃ electron-only structures

E-Mail: garcia@uji.es (G. Garcia-Belmonte)

Phone: +34 964 728040, Fax: +34 964 729218