Master Thesis: "Estudo de processos de transporte eletrônico em dispositivos a base de semicondutores orgânicos", Fernando Araújo de Castro, IFSC-USP, 2004.

ABSTRACT

The subject of this work is the investigation of electronic transport processes in organic semiconductors based devices using advanced techniques, such as electrically detected magnetic resonance (EDMR) and ac electrical impedance spectroscopy. Electron Paramagnetic Resonance (EPR) measurements were also carried out to complement the EDMR results. The studied devices and materials were: MEH-PPV *hole-only* devices and PLEDs, polyaniline and multilayer Alq_3 and α-NPD based OLEDs. EDMR measures the sample conductivity variation during magnetic resonance condition, which allows relating microscopic processes to its effects on electronic transport processes. EPR and EDMR investigations on polyaniline showed a transition between two kinds of observed spins as a function of temperature. The results indicate that EPR probes especially surface paramagnetic states, while EDMR allows observing both surface and bulk paramagnetic states, depending on how devices are prepared and on some measurement parameters. The EDMR signal was assigned to interchain hopping of polarons. On MEH-PPV devices, the EDMR signal was composed of two lines, one was attributed to positive polarons fusion to form positive bipolarons and the other was assigned to negative polarons fusion. The light emitting deficiency presented by some of the PLEDs investigated was assigned to a misbalanced charge injection, what could be observed by the difference between the intensity of the two components. Impedance spectroscopy measurements on Alq_3 based OLEDs as a function of the dc voltage (V_{dc}) showed charge accumulation at the inner interfaces of the device at low V_{dc} values. However, at higher V_{dc} values, when recombination starts to take place, a strange phenomenon, usually called "negative capacitance", was observed. Possible approaches were proposed.