Determination of Deep and Shallow Levels in poly(p-phenylene vinylene) by Capacitance-Transient Methods

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Electroluminescent devices can be made from semiconducting p-conjugated polymers such as the soluble form of poly(p-phenylene vinylene) (MEH-PPV). To control the luminescence efficiency it is important to have knowledge of the deep levels, which can act as non-radiative recombination centers, thus quenching the electro luminescence. One of the most common methods to fingerprint deep levels is DLTS (deep level transient spectroscopy), which is a fast version of the more general capacitance-transient spectroscopy. In the current work we performed capacitance transient methods - for the first time successfully in a semiconducting polymer, in this case MEH-PPV - to identify four trap levels (majority traps at 0.30 eV and 1.0 eV, minority traps at 0.48 eV and 1.3 eV) on top of the shallow acceptor level (0.12 eV) seen in admittance spectroscopy. An abrupt pn-junction of the polymer spin-coated on top of heavily doped (n+) silicon was used to be able to see both majority and minority traps. Moreover, such structures can be technologically important for the integration of polymer structures into silicon devices.