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Modeling thermionic emission-limited current-voltage curves of metal/organic/metal devices

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Abstract

Steady-state current-voltage (IV) characteristics of metal/organics/metal devices are modelled on the basis of thermionic emission into two back-to-back connected diodes separated by a series bulk resistance. It is shown that the analysis of the IV curves cannot be split in two independent branches corresponding to opposite polarities of the applied bias. At low biases both metal/organic barriers influence the current, whereas at elevated biases the (saturation) current is limited by the *non-injecting* diode experiencing reverse bias, along with the bulk resistance. Conditions are simulated when the thermal activation energy (barrier height of the metal/organic contact and/or that of bulk conductivity) can be deduced from IV data taken at different temperatures. The model calculations are also helpful for envisaging the potential distribution across the three zones ($barrier_1$/bulk/$barrier_2$) at different biases. Experimental data on IV characteristics of Ag/Dimethyl-PTCDI/n-GaAs (sulphur-passivated) recorded at different temperatures are treated within the framework of the model. (© 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim)

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