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Dielectric relaxation in a hybrid Ag/DiMe-PTCDI/GaAs device

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Abstract

The electric properties of a metal/organic/inorganic heterostructure were explored by current–voltage (*I–V*), feedback charge capacitance (*C–V*) and charge transient spectroscopy (QTS). Temperature dependent *I–V* characteristics from 100 K to 300 K were recorded while running the bias applied to the metallic electrode from negative to positive values. For increasing positive bias negative currents were observed at low temperatures. In addition, huge dispersion of the time-domain capacitance $C(t)$ was detected after delaying the sampling event t_s from 10^{-6} s to 10^{-2} s with respect to the trailing edge of the probing bias pulse. Finally, biasing the gate electrode from zero to negative bias and back, a reversal of the sign of the transient charge was monitored at the QTS filter output. All the observations point to a *trap-assisted dielectric relaxation*, originating from a charge redistribution of the initial charge (acquired during the pulse) between the two constituents of the hybrid heterostructure during the discharge. A trap level which pins the Fermi level 0.25 eV below the lowest unoccupied molecular orbital (LUMO) in the organic layer was deduced after a multi-Gaussian fitting analysis.

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