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Gate-controlled energy barrier at a graphene/molecular semiconductor junction S. PARUI, L. PIETROBON, D. CIUDAD, S. VELEZ, X. SUN, P. STOLIAR, CIC nanoGUNE, 20018 Donostia-San Sebastian, Basque Country, Spain, F. CASANOVA, L. E. HUESO, CIC nanoGUNE, 20018 Donostia-San Sebastian, Basque Country, Spain; and IKERBASQUE, Basque Foundation for Science, 48011 Bilbao, Basque Country, Spain — The formation of an energy barrier at a metal/molecular semiconductor junction is both a ubiquitous phenomenon as well as the subject of intense research in order to improve the performance of molecular semiconductor-based electronic and optoelectronic devices. For these devices, a junction with a large energy barrier provides rectification, leading to a diode behavior, whereas a relatively small energy barrier provides nearly-ohmic behavior, resulting in efficient carrier injection (extraction) into the molecular semiconductor. Typically, a specific metal/molecular semiconductor combination leads to a fixed energy barrier; therefore, the possibility of a gate-controlled energy barrier is very appealing for advanced applications. Here [S. Parui *et al*, Adv. Fun. Mat. **25**, 2972 (2015)], we present a graphene/C_{60} junction-based vertical field-effect transistor in which we demonstrate control of the interfacial energy-barrier such that the junction switches from a highly rectifying diode at negative gate voltages to a nearly-ohmic behavior at positive gate voltages and at room temperature. We extract an energy-barrier modulation of up to 660 meV, a transconductance of up to five orders of magnitude and a gate-modulated photocurrent.

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