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Thin film barristor: a gate tunable vertical graphene-pentacene-gold device CLAUDIA OJEDA-ARISTIZABAL, WENZHONG BAO, MICHAEL S. FUHRER, Center for Nanophysics and Advanced Materials University of Maryland, College Park — Graphene, a one atom thick crystal made of carbon, shows exciting possibilities as a tunable electrode for semiconductors. Graphene's electrochemical potential can be tuned over a span of electron volts, and graphene is expected to have no interface states. Here we explore graphene as a tunable electrode contacting pentacene, a van der Waals molecular semiconductor which should also have no interface states. We fabricate a vertical thin-film barristor device consisting of highly doped silicon (gate), 300 nm SiO_2 (gate dielectric), monolayer graphene, pentacene, and gold top electrode. During fabrication an intermediate layer of SiO_2 is deposited over the graphene leaving a small hole for the pentacene contact, insuring vertical transport. We show that the current across the device is modulated by the Fermi energy level of graphene, tuned with an external gate voltage. We interpret the device current within thermionic emission theory.

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