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Electric Field-induced Resistance Switching in VO_2 Channels using Hybrid Gate Dielectric of High-k Ta_2O_5/Organic material Parylene-C. TINGTING WEI, TERUO KANKI, Institute of Scientific and Industrial Research, Osaka University, KOHEI FUJIWARA, Institute for Materials Research, Tohoku University, MASASHI CHIKANARI, HIDEKAZU TANAKA, Institute of Scientific and Industrial Research, Osaka University — Electrostatic approach utilizing field-effect transistor (FET) with correlated electron materials provides an avenue to realize the novel devices (Mott-transistor) and to clarify condensed matter physics. In this study, we have prepared Mott-transistors using vanadium dioxide (VO_2) channels and employed hybrid gate dielectric consisted of high-k material Ta_2O_5 and organic polymer parylene-C to trigger carrier transport modulation in VO_2. Obvious resistance modulations were observed in insulating regime through time-dependent resistance measurement at varied square-shaped gate bias (V_G). Contrasting to the hysteretic response in electric double layer transistor (EDLT), an abrupt resistance switching in less than of 2-second-interval enables us to attribute such immediate modulation to pure electrostatic effect. Moreover, the maximum of resistance change was identified to appear around phase transition temperature (T_{MI}), which confirmed the disordered heterogeneous regime at T_{MI}. Taking advantage of systematic modulation using VO_2-based devices, we demonstrated the pronounced shifts of T_{MI} by gate bias. Another fascinating behavior on asymmetric drop in T_{MI} by hole-electron carrier doping was observed.

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