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Gate-tunable gigantic changes in lattice parameters and optical properties in VO_2[1] MASAKI NAKANO, Tohoku University, DAISUKE OKUYAMA, RIKEN Center for Emergent Matter Science (CEMS), KEISUKE SHIBUYA, National Institute of Advanced Industrial Science and Technology (AIST), NAOKI OGAWA, TAKAFUMI HATANO, RIKEN Center for Emergent Matter Science (CEMS), MASASHI KAWASAKI, TAKA-HISA ARIMA, YOSHIHIRO IWASA, University of Tokyo, YOSHINORI TOKURA, RIKEN Center for Emergent Matter Science (CEMS) — The field-effect transistor provides an electrical switching function of current flowing through a channel surface by external gate voltage (VG). We recently reported that an electric-double-layer transistor (EDLT) based on vanadium dioxide (VO2) enables electrical switching of the metal-insulator phase transition, where the low-temperature insulating state can be completely switched to the metallic state by application of VG [1]. Here we demonstrate that VO2-EDLT enables electrical switching of lattice parameters and optical properties as well as electrical current. We performed in-situ x-ray diffraction and optical transmission spectroscopy measurements, and found that the c-axis length and the infrared transmittance of VO2 can be significantly modulated by more than 1% and 40%, respectively, by application of VG. We emphasize that these distinguished features originate from the electric-field induced bulk phase transition available with VO2-EDLT.

[1] M. Nakano et al., Nature 487, 459 (2012).

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