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Resistance modulation in VO_2 nanowires induced by an electric field *via* air-gap gates TERUO KANKI, MASASHI CHIKANARI, TINGTING WEI, HIDEKAZU TANAKA, Osaka University, THE INSTITUTE OF SCIENTIFIC AND INDUSTRIAL RESEARCH TEAM — Vanadium dioxide (VO_2) shows huge resistance change with metal-insulator transition (MIT) at around room temperature. Controlling of the MIT by applying an electric field is a topical ongoing research toward the realization of Mott transistor. In this study, we have successfully switched channel resistance of VO_2 nano-wire channels by a pure electrostatic field effect using a side-gate-type field-effect transistor (SG-FET) *via* air gap and found that single crystalline VO_2 nanowires and the channels with narrower width enhance transport modulation rate. The rate of change in resistance ($(R_0\text{-}R)/R$, where R_0 and R is the resistance of VO_2 channel with off state and on state gate voltage (V_G), respectively) was 0.42 % at V_G =30 V in in-plane poly-crystalline VO_2 channels on Al_2O_3(0001) substrates, while the rate in single crystalline channels on TiO_2 (001) substrates was 3.84 %, which was 9 times higher than that using the poly-crystalline channels. With reducing wire width from 3000 nm to 400 nm of VO_2 on TiO_2 (001) substrate, furthermore, resistance modulation ratio enhanced from 0.67 % to 3.84 %. This change can not be explained by a simple free-electron model. In this presentation, we will compare the electronic properties between in-plane polycrystalline VO_2 on Al_2O_3 (0001) and single crystalline VO_2 on TiO_2 (001) substrates, and show experimental data in detail..

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