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Enhancement of electrical transport modulation in epitaxial VO2 nanowire field-effect transistor HIDEKAZU TANAKA, MASASHI CHIKANARI, TERUO KANKI, Osaka University — Strongly correlated system vanadium dioxide VO2 has attracted widespread concerns from researchers as an exciting electronic material, due to the many intriguing features, especially metal-insulator transition (MIT) in vicinity of room temperature. In this work, we report a diverse geometry for high sensitivity in the transport modulation. By taking advantage of nanometer scale channel, instead of thin film channels, we demonstrated the enhancement of resistance modulation by applying gate voltage. Also we designed the insulating gate, consisting of high-k material Ta2O5/organic polymer parylene-C hybrid insulator. Such as this hybrid gate dielectric would effectively reduce interface deterioration of active channel oxide and provide sufficient carrier density. Moreover, benefited from the nanometer scale channel, the VO2 nanowire-based transistor could deliver a resistance modulation ratio over 8.5%, which are about 10 folds higher than that of the film case. Furthermore, this result is explained that in spite of the stronger field distribution in the edge parts of VO2 nanowire channel yielded little carrier density, the generated mobility modulation would biquadratic increase according to Brinkman-Rice picture as new finding.

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