Electric-Field-Driven Phase Transition in Vanadium Dioxide

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We report on local probe measurements of current-voltage and electrostatic force-voltage characteristics of electric field induced insulator to metal transition in VO_2 thin film. In conducting AFM mode, switching from the insulating to metallic state occurs for electric field threshold $\mathcal{E} \sim 6.5\ 10^7 Vm^{-1}$ at 300 K. Upon lifting the tip above the sample surface, we find that the transition can also be observed through a change in electrostatic force and in tunneling current. In this non-contact regime, the transition is characterized by random telegraphic noise. These results show that electric field alone is sufficient to induce the transition, however, the electronic current provides a positive feedback effect that amplifies the phenomena.
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