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Electronic switching in nanoscale titanium oxide devices DUNCAN STEWART, Hewlett-Packard Laboratories, Palo Alto, CA USA, J. JOSHUA YANG, JULIEN BORGHETTI, DOUGLAS OHLBERG, MATTHEW PICKETT, FENG MIAO, R. STANLEY WILLIAMS — Titanium metal is widely used as a top metal contact for nanoscale molecular electronic devices, where it has been assumed to form a few-atom-thick Ti carbide overlayer. Using a vacuum delamination technique we expose and analyze chemically pristine buried titanium/organic monolayer interfaces from devices that have displayed 'molecular electronic switching'. We establish that under many conditions the titanium instead forms a *few-nanometer-thick Ti oxide* overlayer. Both TiO2 and reduced TiOx species exist – this mixed stoichiometry Ti oxide is responsible for the electronic switching. In the separate field of 'conventional' nano-electronics, oxide based electrical-resistance switches are pursued for next generation nonvolatile random access memories (R-RAMs). However, the metal/oxide/metal switching mechanism is poorly understood. We demonstrate in Pt/TiOx/Pt nanocrosspoint devices that the switching is channeling (on) and recovering (off) the Schottky barrier at the Pt/TiO2 interface due to the creation and drift of positively charged oxygen vacancies under electric field. Engineered oxygen vacancy profiles predictively control the switching polarity and conductance to support a general physics model of switching in these devices.

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