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Field-Effect Modulation of Ambipolar Doping and Domain Wall Band Alignment in P-type Vanadium Dioxide Nanowires YASEN HOU, XINGYUE PENG, YIMING YANG, DONG YU, Univ of California - Davis — The sub-picosecond metal-insulator phase transition in vanadium dioxide (VO_2) has attracted extensive attention with potential applications in ultrafast Mott transistors. However, the development of VO_2-based transistors lags behind, owing to the lack of an efficient and hysteresis-free electrostatic doping control. Here we report the first synthesis of p-type single crystalline VO_2 nanowires via catalyst-free chemical vapor deposition. The p-type doping was unambiguously confirmed by both solid and electrochemical gating methods, and further evidenced by the scanning photocurrent microscopic measurements. Interestingly, we observed that the photocurrent spot polarity at the metal-insulator domain walls was reversibly switched by electrochemical gating, which indicates a band bending flipping. Furthermore, we eliminated the common hysteresis in gate sweep and greatly shortened the transistor response time via a hybrid gating method, which combines the merits of liquid ionic and solid gating. The capability of efficient field effect modulation of ambipolar conduction and band alignment offers new opportunities on understanding the phase transition mechanism and enables novel electronic applications based on VO_2.

Yasen Hou
Univ of California - Davis

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