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Atomic hydrogen doping in single-crystal vanadium dioxide HENG JI, Department of Physics and Astronomy, Rice University, WILL HARDY, Applied Physics Graduate Program, Rice Quantum Institute, JIANG WEI, Department of Physics and Engineering Physics, Tulane University, JIAN LIN, Department of Chemistry, Rice University, HANJONG PAIK, DARRELL SCHLOM, Department of Materials Science and Engineering, Cornell University, DOUGLAS NATELSON, Department of Physics and Astronomy, Rice University — Vanadium dioxide is a strongly correlated material with a bulk metal-to-insulator transition (MIT) near 340 K. Previous experiments in single-crystal nanowires (J. Wei et al., Nature Nano. 7, 357-362 (2012)) have shown that catalytic doping with atomic hydrogen can stabilize the high temperature metallic state. In this experiment, we used a hot filament source to split hydrogen molecules and directly dope atomic hydrogen into VO2 material, including epitaxial films and nanowires, without any catalyst. From observations of the wire samples, we infer the relative diffusion rates of H in the monoclinic and rutile crystal structures. Transport measurements of the doped film samples show no temperature-driven transition, but rather a conducting state down to 2K. We present Hall and magnetoresistance measurements on macroscale and mesoscale devices fabricated from the doped films.

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