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Hydrogen doping and the metal-insulator transition in vanadium dioxide TALIP SERKAN KASIRGA, CHUNMING HUANG, JAE H. PARK, JIM M. COY, ZAIYAO FEI, AARON M. JONES, XIAODONG XU, DAVID H. COBDEN, University of Washington Department of Physics — Vanadium dioxide has a first-order metal-insulator transition (MIT) at 67 °C. It has recently been shown [1] that hydrogen doping of VO_2 by spillover from a metal catalyst in hydrogen gas gradually reduces the gap in the insulating phase to zero, and eventually eliminates the MIT. The dependence on hydrogen concentration enables optical and electrical detection of the local hydrogen density. We exploit this to study the diffusion of hydrogen and its dependence on temperature, direction, strain, and phase in single-domain nanobeams and platelets of VO_2. For example, we find that diffusion is faster along the rutile c-axis, and can be significant even at the transition temperature. We also study the effects of hydrogen doping on the phase diagram, on the low temperature conductivity, and on the continuous-wave and ultrafast optical response.

[1]. Wei, J. *et. al.* Nature Nano. **7**, 357 (2012)

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