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Mapping and Exploration of Extensive Stress-Temperature Phase Diagram of Vanadium Dioxide J. CAO, W. FAN, University of California, Berkeley, D.F. OGLETREE, Molecular Foundry, LBNL, K. CHEN, N. TAMURA, M. KUNZ, Advanced Light Source, LBNL, C. BARRETT, J. SEIDEL, E. SAIZ, J. WU, University of California, Berkeley — Vanadium dioxide is a prototypical strongly correlated electron material exhibiting a metal-insulator phase transition. This electronic transition is complicated by accompanied structural changes that involve one tetragonal and two monoclinic structures, each favored at different strain states. Full understanding of the driving mechanism of these coupled transitions necessitates concurrent structural and electrical measurements over all phases. These measurements are obstructed in VO_2 bulk and thin films, because domain structures developed at the sub-micron scale relax local strain and limit the accessible phase space. Enabled by superior mechanical property of crystalline microbeams, we demonstrate mapping and exploration of the stress-temperature phase diagram of VO_2 over a phase space that is more than one order of magnitude broader than previously attained. Electrical and structural properties of all three phases and transitions between them were evaluated. New structural and electronic aspects were observed along the phase transitions in high strain states. This work was supported in part by NSF under Grant No. EEC-0425914, and in part by the Laboratory Directed Research and Development Program of LBNL under the DoE Contract No. DE-AC02-05CH11231. Portions of this work were performed at the Molecular Foundry and at the Advanced Light Source, LBNL.

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