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Subdomain studies of the metal-insulator transition in VO_2 nanobeams[1] JIANG WEI, JAE HYUNG PARK, JACOB BEEDLE, ZENGHUI WANG, WEI CHEN, GEETA YADAV, DAVID COBDEN, Department of Physics, University of Washington — In many correlated materials, domain structure causes the bulk properties to differ from those on the sub-domain level. In addition, near first-order phase transitions it leads to transition broadening, hysteresis, and sample degradation. Studies of nanoscale crystals enable investigations of the domain-free homogeneous material. We demonstrate this by working with nanobeams of vanadium dioxide, thereby discovering or clarifying multiple aspects of its famous metal-insulator transition at 67°C. Amongst them are that the transition to the metal occurs at a constant value of the resistivity of the insulating phase; large supercooling of the homogeneous metallic phase is possible; and the activation energy in the insulating phase is consistent with the optical gap, in contrast with earlier reports on bulk samples. The nanobeams also enable new classes of experiments, including investigating a single metal-insulator interphase wall, employing nanomechanical effects to determine the equilibrium transition temperature, and investigating the dynamics of a phase transition in quasi-one-dimensional geometry.

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