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The M2 phase of vanadium dioxide: a view from infrared and optical spectroscopy T.J. HUFFMAN, PENG XU, M.M. QAZILBASH, Department of Physics, College of William and Mary, JOONSEOK YOON, HONGLYOUL JU, Department of Physics, Yonsei University, Korea, R. SMITH, G.L. CARR, Photon Sciences, Brookhaven National Laboratory — Bulk single crystalline vanadium dioxide (VO_2) undergoes a metal-insulator transition (MIT) at 340K. This thermally-driven MIT is accompanied by a structural phase transition that results in pairing of all vanadium ions in the insulating, monoclinic M_1 phase. However, there also exists an insulating monoclinic M_2 phase, usually only accessible via external strain or chemical doping, in which only half of the vanadium chains exhibit pairing. The M_2 phase of VO_2 is vital for understanding the roles of electronic correlations and vanadium pairing to the MIT. Recent x-ray diffraction studies show that small pure VO_2 crystals can exhibit an M_2 phase below 318K, likely due to internal strain.[1] These crystals undergo phase transitions from M_2 to M_1 and from M_1 to rutile metal upon heating. We have performed reflectance micro-spectroscopy with polarized light and generalized spectroscopic micro-ellipsometry between 12 meV and 5.5 eV on these VO_2 crystals as a function of temperature, uncomplicated by external strain or chemical doping. We report infrared and optical data on the M_1, M_2 and rutile phases and compare electronic and phonon properties of M_1 and M_2 phases.

[1]B.S. Mun et al. Physica Status Solidi (RRL) - Rapid Research Letters 5, 107 (2011).

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