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Direct correlation of structural domain formation with the metal-insulator transition in VO_2nanobeams SHIXIONG ZHANG, JUNGYEN CHOU, LINCOLN J. LAUHON, Northwestern University — While the metal-insulator transition in VO_2 bulk and thin films has been investigated for decades, recent studies of nanobeams have provided new insights into nature of the phase transition, in particular the relationship between inhomogeneous strain and metal/insulator domain formation. We have used Raman spectroscopy mapping of single nanobeam electrical devices at varying temperatures to directly correlate the domain structure with electrical resistance. With increasing temperature, clamped nanobeams transform from the insulating monoclinic M_1 phase to a mixture of the metastable Mott-insulating M_2 phase and the metallic rutile phase. Domain fractions were used to extract the temperature dependent resistivity of the M_2 phase, which shows an activated behavior consistent with the expected Mott-Hubbard gap. A metallic monoclinic M_2 phase was also produced by direct injection of charge into the device, providing evidence of an insulator-to-metal transition without a structural phase transformation.

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