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Low-frequency noise spectroscopy of vanadium dioxide along the metal to insulator transition SAHAR KESHAVARZ, PATRICK LECLAIR, Center for Materials for Information Technology (MINT), Department of Physics and Astronomy, University of Alabama Tuscaloosa, Al 35487, USA, ARUNAVA GUPTA, Center for Materials for Information Technology (MINT), Department of Chemistry, University of Alabama Tuscaloosa, Al 35487, USA, SANJOY SARKER, Department of Physics and Astronomy, University of Alabama Tuscaloosa, Al 35487, USA — VO_2 exhibits ultrafast, reversible metal-insulator transition (MIT) around T $\sim$ 340K. Origin and mechanism of VO_2 MIT has been controversial, since it simultaneously undergoes a structural transition. One key feature of the MIT is coexistence of metallic and insulating regions over a broad temperature range. We propose low-frequency noise spectroscopy to clarify the nature of this phase coexistence. Noise spectroscopy is more sensitive to details of current distribution, and thus the distribution of metallic and insulating regions, than traditional transport. Epitaxial films of VO_2 have been deposited on (100), (110) and (001) TiO_2 substrates by CVD and were tested by XRD, resistivity versus temperature, and AFM to ascertain quality. As the result, low-frequency 1/f noise amplitude diverges around onset of transition along c-axis, with noise depending non-monotonically on resistivity. On the other hand, it depends monotonically on resistivity along a-axis. This indicates the critical role of structural dynamics during the transition, and in particular strongly suggests that fluctuations of the V-V dimers along c-axis play a prominent role in MIT. Our findings contradict expectations for noise behavior based on simple percolation models.

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