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Terahertz time-domain reflection spectroscopy of the insulator-to-metal phase transition in vanadium dioxide AIDAN O'BEIRNE, LUKE MCCLINTOCK, JEREMY CURTIS, The University of Alabama at Birmingham, RICHARD HAGLUND, Vanderbilt University, DAVID HILTON, The University of Alabama at Birmingham — Terahertz time-domain spectroscopy is a well-established experimental technique that is commonly used to determine the complex dielectric constants of condensed matter systems. This experiment typically measure samples in transmission since the analysis methods for reflection geometry have well known phase ambiguities that cannot easily be overcome. This is a significant limitation since materials with strong absorption can often be studied only in reflection and also because some experimental geometries, like the high field magnets at NHMFL, only permit reflection measurements. To develop a new terahertz reflection spectroscopy method, we have performed terahertz time-domain spectroscopy of vanadium dioxide (VO_2), which exhibits a insulator-to-metal phase transition at 340 K, as a function of temperature in a novel reflection geometry that includes a second reference beam to overcome the prior phase ambiguities. Our analysis uses the Characteristic matrix method to determine the complex dielectric constants as a function of temperature, which we have measured between 315 K to 365 K and then back to 315 K. We have obtained the complex conductivity of this VO_2 sample, which agrees with the known conductivity hysteresis of this material.

David Hilton
The University of Alabama at Birmingham

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