Metal-insulator phase transition in a VO2 thin film observed with terahertz spectroscopy - DTU Orbit (03/10/2019)

**Metal-insulator phase transition in a VO2 thin film observed with terahertz spectroscopy**

We investigate the dielectric properties of a thin VO2 film in the terahertz frequency range in the vicinity of the semiconductor-metal phase transition. Phase-sensitive broadband spectroscopy in the frequency region below the phonon bands of VO2 gives insight into the conductive properties of the film during the phase transition. We compare our experimental data with models proposed for the evolution of the phase transition. The experimental data show that the phase transition occurs via the gradual growth of metallic domains in the film, and that the dielectric properties of the film in the vicinity of the transition temperature must be described by effective-medium theory. The simultaneous measurement of both transmission and phase shift allows us to show that Maxwell-Garnett effective-medium theory, coupled with the Drude conductivity model, can account for the observed behavior, whereas the widely used Bruggeman effective-medium theory is not consistent with our findings. Our results show that even at temperatures significantly above the transition temperature the formation of a uniform metallic phase is not complete.

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