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Distinguishing the Photothermal and Photoinjection Effects in Vanadium Dioxide Nanowires[1] XI WANG, HANWEI GAO, Department of Physics, Florida State University — Vanadium dioxide (VO_2) has drawn significant attention for its unique metal-to-insulator transition. The high electrical resistivity below the transition temperature is a result of the strong electron correlation with the assistance of lattice distortion. Theoretical calculations indicated that the strong inter-electron interactions might induce intriguing optoelectronic phenomena, such as the multiple exciton generation. However, the resistivity of VO_2 is temperature sensitive. Therefore, the light-induced conductivity in VO_2 has often been attributed to the photothermal effects. In this work, we distinguished the photothermal and photoinjection effects in VO_2 nanowires by varying the chopping frequency of the optical illumination. In our VO_2 nanowires, the relatively slow photothermal processes can be well suppressed when the chopping frequency >2 kHz, whereas the fast photoinjection component (direct photo-excitation of charge carriers) remains constant at all chopping frequencies. By separating the photothermal and photoinjection processes, our work set the basis for further studies of carrier dynamics under optical excitations in strongly correlated materials.

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