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Ultrafast carrier dynamics in $BiVO_4$ thin film photoanode material: time-resolved THz spectroscopic study. WESLEY BELLEMAN, Department of Physics, Worcester Polytechnic Institute, L. ZHOU, B. GIRI, Department of Mechanical Engineering, Worcester Polytechnic Institute, B.J. DRINGOLI, Department of Physics, Worcester Polytechnic Institute, P.M. RAO, Department of Mechanical Engineering, Worcester Polytechnic Institute, L.V. TITOVA, Department of Physics, Worcester Polytechnic Institute — Recent demonstrations of 3% solar conversion efficiency in thin film $BiVO_4$ make it a promising photoanode material for photoelectrochemical water oxidation [1]. With a bandgap of 2.4 eV, it strongly absorbs UV and visible light up to 520 nm. However, its efficiency is limited by extremely poor carrier mobility, with values from 0.01 to 1 cm^2 /Vs reported in the literature, and often attributed to formation of small polarons [2]. The precise nature of conductivity in $BiVO_4$ is, however, not well-established. We use time-resolved terahertz (THz) spectroscopy as a non-contact probe of microscopic photoconductivity of a 100 nm-thick $BiVO_4$ film. THz spectroscopy allows probing the dynamics of photo-injected carriers over nanometer length scales, and thus provides insight about transport of carriers inside the 100-200 nm grains. We find that intra-grain mobility may be as much as several orders of magnitude higher than macroscopic mobility that is affected by the grain boundaries. References [1] P. M. Rao et al., Nano Lett. 14, 1099 (2014) [2] A.J.E. Rettie et al., Appl. Phys. Lett. 106, 022106 (2015).

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