Photoconductivity of Few-Layer $MoTe_2$

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Abstract – A photoconductivity study of few-layer $MoTe_2$ in a field effect transistor (FET) configuration was performed to find the photoresponsivity and photocurrent response of the material. The mechanisms for $MoTe_2$ with no applied gate voltage were found to be dominated by the photovoltaic effect, showing its potential for use in solar cells. Due to the band gap of $MoTe_2$ being 1.1 eV, $MoTe_2$ is a suitable photodetector for optical wavelengths and potentially the near infrared.

Transition metal dichalcogenides (TMDCs) have been the subject of intense research due to their impressive optoelectronic properties, showing lower noise photodetection than silicon photodiodes,[1] and high photoresponsivities.[2-4] $MoTe_2$ has a band gap of ~1 – 1.2 eV from bulk to the monolayer thickness, transitioning to a direct gap at monolayer thickness.[5] In our work, we measure the optoelectronic properties of this overlooked TMDC as a transistor and photodetector. We fabricated the FETs using electron beam lithography and thermal evaporation of a Cr/Au layer. We characterized the layer thickness using three techniques, optical contrast, atomic force microscopy and Raman spectroscopy. Measurements were taken using a DC measurement setup and a 685 nm laser and 50x objective lens. So far our results show signs that $MoTe_2$ is suitable for both fast and responsive photodetection.

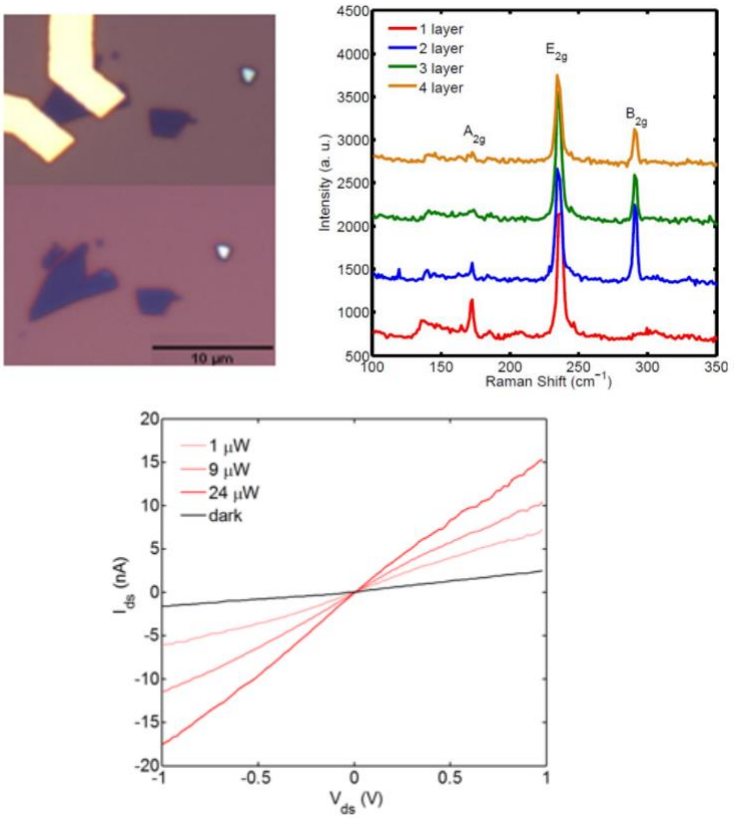

Fig. 1(a) we show an optical image of a 4 layer $MoTe_2$ flake before and after our fabrication. In Fig. 1(b) the Raman spectra of $MoTe_2$ is included up to four layers, the ratio of areas underneath the E^1_{2g} and B^1_{2g} peaks provide information for the layer thickness. Fig. 1(c) An output characteristic of few layer $MoTe_2$ with a 685 nm laser up to powers of 24 μW.

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