Characterization of the nonlinear optical susceptibilities of monolayer MoS_2 and comparison with graphene

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Abstract

We report the determination of the second and, for the first time, third order optical nonlinear susceptibilities of monolayer MoS_2 by measurements of second and third harmonic generation [1]. The measurements were made using a nonlinear optical microscope (Figure 1) with a 1560nm wavelength (non-resonant) pump beam. The experimental system also enables high resolution third harmonic imaging. The measured susceptibilities, inferred from the dependence of third harmonic intensity on pump beam intensity and interpreted as sheet susceptibilities [2] are:

$\left|\chi_s^{(2)}\right| = 2\times10^{-20} m^2 V^{-1}$ and

$\left|\chi_s^{(3)}\right| = 1.7\times10^{-28} m^3 V^{-2}$

The third order susceptibility of graphene was determined, using the same experimental setup, to be approximately 3.4 times lower than that of MoS_2 (Figure 2). The results highlight the potential of MoS_2 for low footprint nonlinear optical devices in the telecommunications C-band.

References

[1] R. I. Woodward et al, 2D mater, **4** (2016) 011006
[2] Y. R. Shen, An. Rev. Chem, **40** (1989) 327

Figures

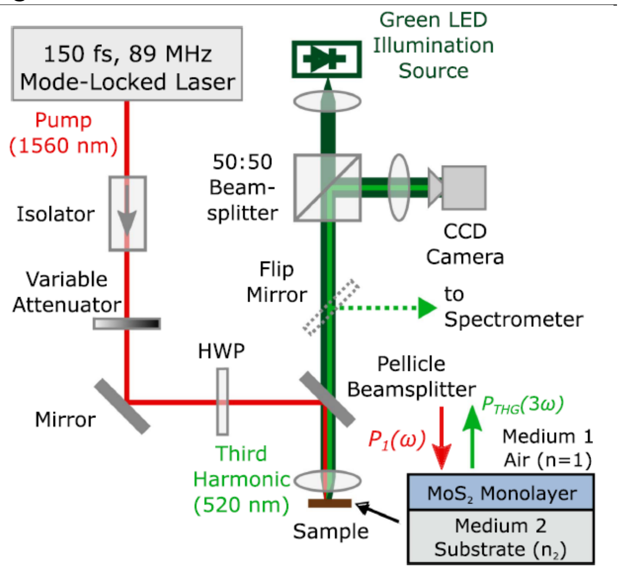

Figure 1: The nonlinear optical microscope used for the measurements.

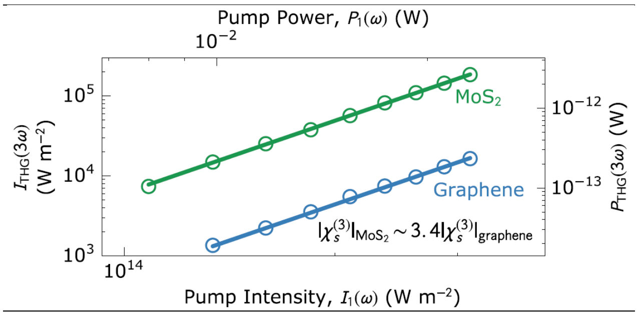

Figure 2: Dependence of third harmonic intensities on pump beam intensity in monolayer MoS_2 and graphene.

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