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Wavelength-dependent polarized second harmonic generation in MoS_2/WSe_2 heterostructure

Second harmonic generation (SHG) is a useful experimental method to determine the crystallographic orientation of transition metal dichalcogenide (TMD) samples. By monitoring the intensity of the SHG signal as a function of the polarization directions of the excitation and the second harmonic light, one can determine the crystallographic directions unambiguously when the crystal symmetry allows SHG. In homojuctions of TMDs, it has been reported that the polarization dependence of the SHG signal depends on the relative orientations of the two layers [1]. In this work, we tried to measure the crystal orientation of each layer separately using the enhancement of the SHG signal when the SHG energy is resonant with the exciton energies [2]. We carried out polarized SHG measurements on MoS_2/WSe_2 heterostructures by using various excitation wavelengths. When the excitation laser energy corresponds to the half of the exciton energy of one of the constituent layers, the SHG signal from that particular layer is selectively enhanced. We show that one can determine the crystallographic orientations of the constituent layers independently by using excitation energies that induce the SHG enhancement of only of the layers. Moreover, we measured polarized SHG for a wide excitation wavelength range (1200 to 1600 nm) to investigate the excitation energy dependence of the polarized SHG response.

References

[1] W. Hsu *et al*., ACS Nano, **8** (2014) 2951
[2] G. Wang *et al*., Phys. Rev. Lett. **114** (2015) 097403

Figures

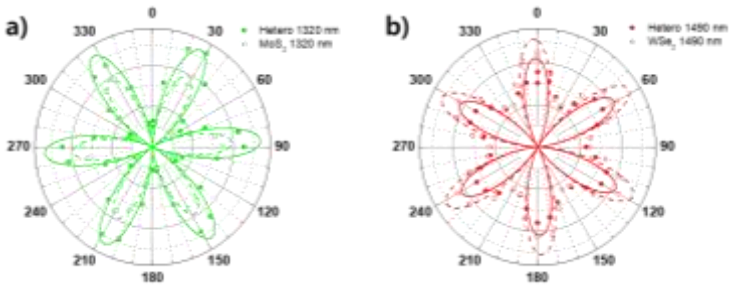

Figure 1: Polarization dependent SHG results on hetero(solid) and individual(open) region. a) and b) are obtained using excitation energies that are half of the A exciton energies of MoS_2 and WSe_2, respectively