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Interlayer interaction of MoS_2 depending on stacking order

We studied interlayer interaction in few-layer MoS_2 depending on the stacking type by using Raman spectroscopy. Stacking type of few-layer MoS_2 can be identified by low-frequency Raman measurements [1]. We prepared 2H-, 3R-, and mixed- stacking type few-layer MoS_2 by mechanical exfoliation and measured the Raman spectra with three excitation energies of 1.96, 2.41, and 2.81 eV. When the 1.96 eV excitation energy resonant with exciton states is used, we observe Davydov splitting of the A_{1g} mode for thicker than 3L. Since Davydov splitting is the splitting of degenerated vibrational bonds caused by the interlayer interaction, Raman spectra of the A_{1g} mode, such as peak position and peak shape, are dependent on the stacking type. We calculated the force constant of 2H-MoS_2 by using the linear chain model with the low-frequency and the Davydov splitting peak positions [2, 3]. For the 3R stacking type, the peak positions and the intensity ratio between the Davydov-split modes differ from the 2H case.

References

[1] J.-U. Lee *et al*., ACS nano, 10 (2016) 1948.
[2] K. Kim *et al*., ACS nano, 10 (2016) 8113
[3] G. Froehlicher *et al*., Nano Lett., 15 (2015) 6481

Figures

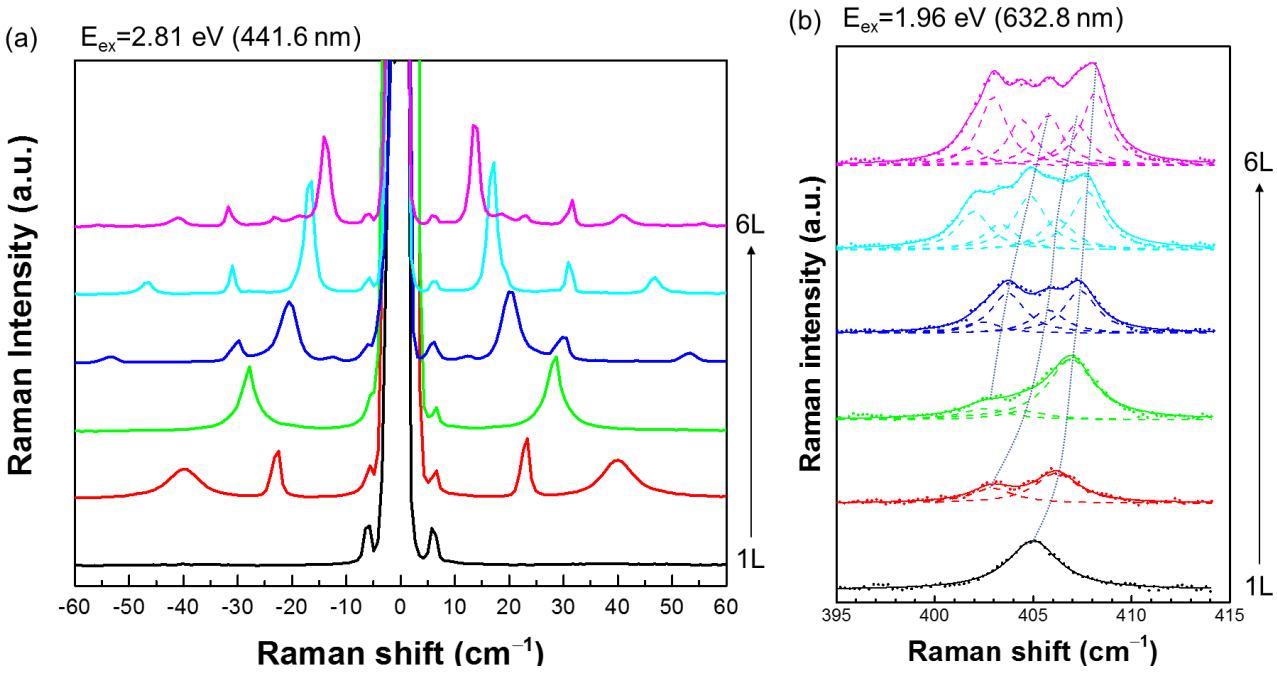

Figure 1: Raman spectra of 2H-type few-layer MoS_2 (a) in the low-frequency region and (b) the A_{1g} mode.