Phonon properties of MoS_2 thin films probed by Raman spectroscopy

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Abstract

Raman spectroscopy has proven to be a fast, effective and reliable tool for studying properties of 2D materials and thin films [1]. Here, we present a study of the phonon properties of exfoliated thin MoS_2 films in the range from a few to several hundred nanometers, deposited on Si substrate.

We focus on phonon properties as a function of ambient temperature and local optical heating, which combined with numerical simulation of heat dissipation can lead to the extraction of total interface conductance and anisotropy of thermal conductivity [2]. All measurements were taken in an ambient atmosphere and special attention was paid to their stability and non-destructive character [3].

This work contributes to a better understanding of the thermal properties of thin films, which are crucial for heat management in thin film applications.

References

[1] Paillet, M., Parret, R., Sauvajol, J. L., & Colomban, P. Journal of Raman Spectroscopy 49 (2018): 8.

[2] Judek J., Gertych, A. P., Świniarski, M., Łapińska, A., Dużyńska, A., & Zdrojek, M. Scientific reports 5 (2015): 12422.

[3] Judek, J., Gertych, A. P., Krajewski, M., Czerniak, K., Łapińska, A., Sobieski, J., & Zdrojek, M. Carbon, 124 (2017): 1.

Figures

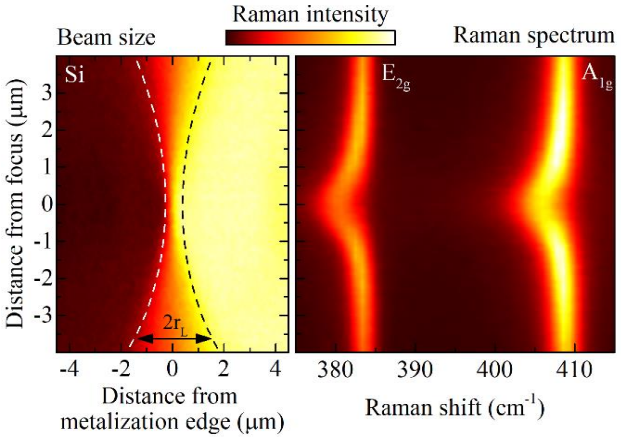

Figure 1: Left: The size of the laser beam as a function of the distance from focal point. Picture shows intensity of Si mode at the metallization edge (knife edge technique). Right: Example of change in Raman spectrum of MoS_2 thin film as a function of distance from focal point (beam size).

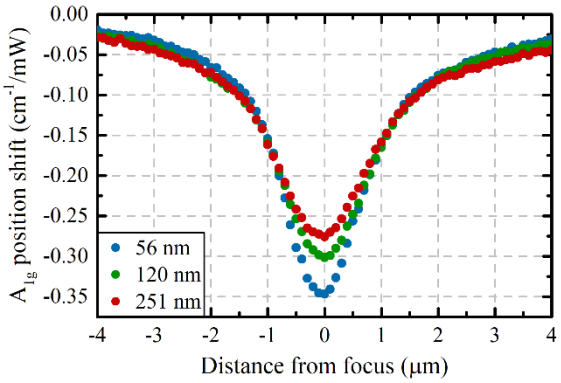

Figure 2: Example of local optical heating of thin films with thicknesses 56, 120, and 251 nm. Change in position of A_{1g} mode on 1mW of incident laser power versus distance from focus (beam size).

Acknowledgments

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