

Study of 2D materials by circularly polarized Raman spectroscopy

Marcos A. Pimenta

Pablo. R. Lima and Hallen D Calado

CTNano, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil

mpimenta11@gmail.com

Raman spectroscopy is a very useful tool to investigate 2D materials, such as graphene and transition metal dichalcogenides of the MoS₂ family, since it provides fundamental information about their physical properties [1]. Linear polarized Raman spectroscopy allows the determination of the phonon symmetries [2] and with circular polarized spectroscopy we can study phonons that preserve or change the photon helicities [3]. In this work we investigate the influence of the incident and scattered laser circular polarization on the spectrum of single-layer (1L), twisted bilayer graphene (TBG) and MoS₂, WS₂ and WSe₂ samples with 1L, 2L and many layers. The variation of circular polarization was clockwise (R) and counterclockwise (L) and the RR and RL spectra shows the phonons that preserve and change, respectively, the scattered photon helicity. We will show that the different polarization combinations selectively activate the intensities of the A or E symmetry Raman modes, as well as the second-order bands. Results also show that circularly polarized Raman spectroscopy is useful to characterize defects and edges in 2D materials.

References

- [1] B. R. Carvalho and M. A. Pimenta, 2D Materials_7, Issue 4 (2020) 042001
- [2] M. A. Pimenta, G. C. Resende, H. B. Ribeiro, B.R. Carvalho, Physical Chemistry Chemical Physics 23, (2021) 27103–27123
- [3] Zhao Y, Xu B, Tong L, Zhang J., Sci China Chem 65 (2022) 269–283.