Raman and PL at the nanoscale: why it really matters for 2D materials

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It's common knowledge that Raman spectroscopy is a very important technique for characterization of 2D materials, such as graphene, TMDCs, MXenes, etc. Hyperspectral microscopic Raman imaging can further help in identification of heterogeneities in 2D materials and their heterostructures.

Quite often the scale of structural, electronic or morphological heterogeneity in these materials is on the order of few tens of nanometers or less, which is beyond the spatial resolution of conventional Raman microscopy. Tip enhanced Raman scattering (TERS) and tip enhanced photoluminescence (TEPL) can address the problem of spatial resolution.

In this talk, we'll demonstrate how TERS and TEPL imaging can probe number of nanoscale heterogeneities in 2D TMDCs and MXenes: growth related, including lateral and vertical heterostructures, substrate induced, and the morphological heterogeneities that appear (intentionally or not) in the process of exfoliation/ 2D crystal transfer. Finally, we'll discuss a hot-fresh results on TERS imaging of graphene nanoribbons and exciting demonstration of the ultra-low frequency TERS which opens the gates to a wonderland of nanophononics.

References

[1] Nature Communications 9, 2891 (2018)
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Figures

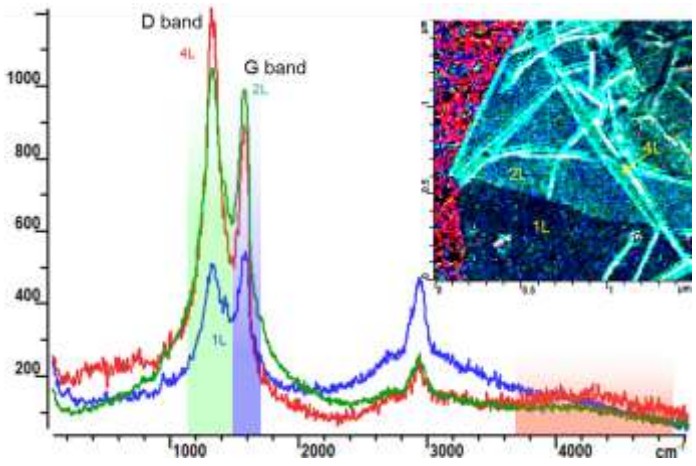

Figure 1: TERS spectra and image of graphene oxide