Correlated Tip-Enhanced Optical Spectroscopy and SPM on 2D materials

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Raman spectroscopy and confocal Raman microscopy have already proved to be essential characterization tools in many areas of advanced research, with a number of these applications extending into industry. As time moves on, new applications that are not addressed by existing technologies arise. Indeed, at the nanoscale, materials exhibit different properties than at the macro level, often quite dramatically different.

The characterization of nanomaterials naturally requires imaging techniques with resolution at the same scale or better, so that local property variations can be discerned, and defects properly detected; only with this understanding can the material properties be engineered to meet the performance requirements of next-generation devices. In this talk, we will present new nano-imaging capabilities to perform such measurements. Tip-enhanced optical spectroscopies (TEOS) such as TERS (tip-enhanced Raman spectroscopy) and TEPL (tip-enhanced photoluminescence) provide a unique capability for the characterization of 2D materials [1, 2]. We will demonstrate the power and importance of the cross-correlation of nanoscale hyperspectral imaging with data from other scanning-probe techniques such as topography, surface potential, conductivity and photocurrent [3, 4].

References

[1] Nanoscale 10, 14055 (2018).
[2] 2D Materials 4, 021024 (2017).
[3] Nature Communications 9, 2891 (2018).
[4] 2D Materials 5, 035003 (2018).

Figure

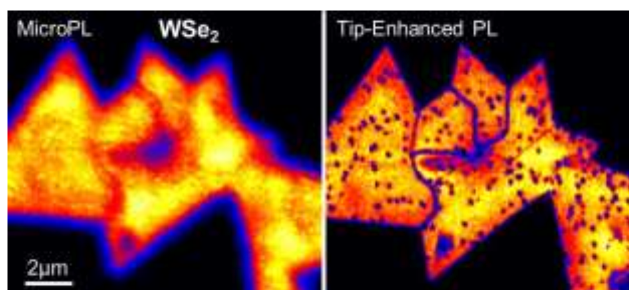

Figure 1: microPL (left) and Tip-Enhanced PL (righ) images of the same WSe_2 flake.