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**Abstract :** Monolayers of transition metal dichalcogenides are very appealing for electronics, optoelectronics and photo/electro-catalysis. Despite the rapid progresses of synthesis methods, device performances remain very sensitive to defects and inhomogeneities (edges, second-layer islands, grain boundaries). Global characterization techniques such as mobility measurements in FETs or catalytic activity measurements by voltammetry cannot assess the impact of inhomogeneities. Local techniques (spectroscopy mapping, scanning probes...) are thus particularly important in the field of 2D materials.

In the group, we synthesize TMDCs monolayers by CVD and integrate them in devices, notably FETs with thin and robust molecular layers as efficient gate-dielectrics able to preserve mobility. In this presentation, I will first present our device-oriented motivations, our synthesis results and their characterization by conventional means. I will then present the development of other local techniques with the aim of illustrating their specific assets for the field of 2D materials. The BALM technique (backside absorbing layer microscopy), first developed as a high-contrast imaging technique, can be used to measure the complex refractive index of TMDCs or to detect surface contamination on monolayers with high sensitivity. Single-pass KPFM (kelvin-probe force microscopy) can map surface potential with high accuracy, and in particular monitor charge accumulation at grain boundaries. We notably use it on operating FETs. SECM (scanning electro-chemical microscopy), usually used to map electrochemical activity, can also be turned into a new contact-less method to measure 2D material conductivity and flake-flake contact resistance.

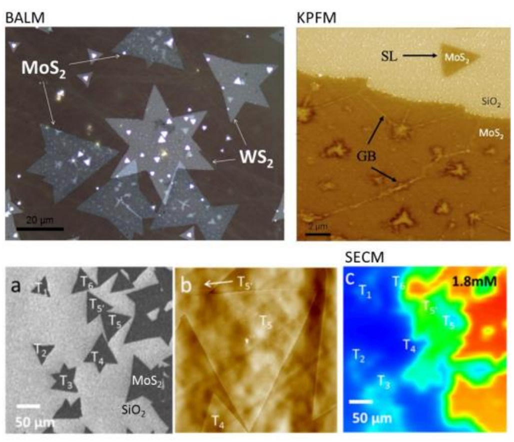


Fig. (top-left) BALM image of $MoS_2$ and $WS_2$ on gold; (top-right) single-pass KPFM surface potential map of $MoS_2$ monolayers; (bottom) conductivity measurement of $MoS_2$ monolayers by SECM (right) and same area first imaged by SEM and AFM (left).

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