Thickness dependent properties of transition metal dichalcogenides using gold-assisted exfoliation

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Scanning tunneling microscopy (STM) and spectroscopy experiments of transition metal dichalcogenides (TMDs) as function of their thicknesses hold promise for uncovering interesting physical properties. Thickness dependent properties can be very efficiently addressed in mechanically exfoliated bulk crystals. However, the original exfoliation on silicon-oxide substrates often fails to give thin flakes of materials with strong interlayer coupling. Gold substrates, owing to the strong chemical interaction of chalcogens with noble metals like gold, offer an attractive alternative for the exfoliation of TMDs into thin layers (including monolayers) [1]. We will present preliminary results using ultra-flat template stripped gold surfaces [2] in place of freshly prepared surfaces for exfoliating selected TMDs. They are appealing due to their simple preparation techniques and their ability to be stored for long time without being exposed to the environment and hence contamination. Furthermore, they also provide a suitable base for STM experiments.

[1] Velicky, M., Donnelly, G. E., Hendren, W. R., McFarland, S., Scullion, D., DeBenedetti, W. J., ... and Huang, F. (2018). Mechanism of gold-assisted exfoliation of centimeter-sized transition-metal dichalcogenide monolayers. ACS nano, 12(10), 10463-10472.

[2] Vogel, N., Zieleniecki, J., and Köper, I. (2012). As flat as it gets: ultrasmooth surfaces from template-stripping procedures. Nanoscale, 4(13), 3820-3832.