Charge and spin transport through large spin-orbit coupling 2D materials

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Two dimensional (2D) materials are fascinating for the novel physics they provide. Their unique electrical, optical and mechanical properties offer a huge panel of applications. In particular, recently discovered transition metal dichalcogenides (TMDs) exhibit a ware particularly promising [1].
Tungsten diselenide (WSe_2), a representative TMD, is a semiconductor characterized by a large spin-orbit coupling making it an interesting material for spin transport and valley physics. With its electronic properties, WSe_2 is a good candidate for field effect transistors (FET) with high ON/OFF ratio.
However, these FET are very dependent on the quality of the metal-semiconductor contacts. In fact, between the metal and the TMD, a large contact resistance induced by a Schottky barrier created on the interface, prevents from having high performance FET [2][3].
To clarify this link, we show both the gate voltage and the temperature dependence of the contact resistance leading to Schottky barrier height modulation. We also show WSe_2 based heterostructures fabricated for spintronics measurements.

References

[1] X. Mingsheng, L. Tao, S. Minmin, C. Hongzheng, Chemical Reviews, 113 (2013), 3766
[2] J. Kang, W. Liu, D. Sarkar, D. Jena, K. Banerjee, PRX, 4 (2014), 31005
[3] A. Allain , J. Kang , K.Banerjee, A. Kis, Nature Materials, 14 (2015), 1195

Figures

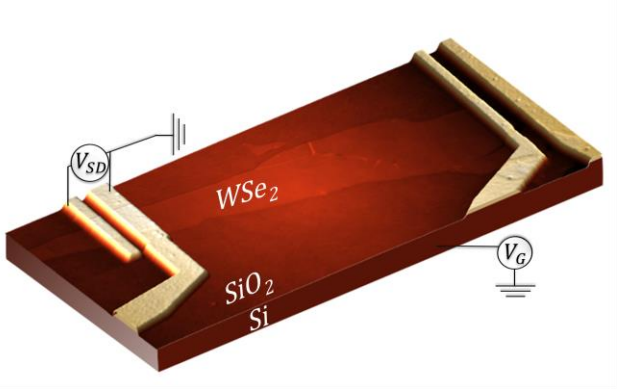

Figure 1: Three-dimensional atomic force image of a final device with four Ti (5 nm)/Au (95) electrodes.

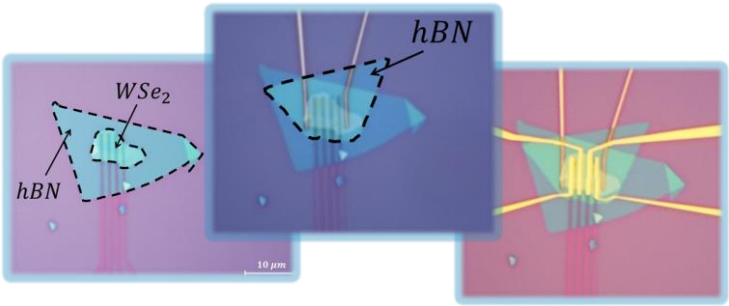

Figure 2: WSe_2 based heterostructures for spintronics.