Synthesis of high-quality 2D transition metal dichalcogenides

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Two dimensional transition metal dichalcogenides have attracted intense attention because of its unique properties. However, synthesis of TMDs in the past few years only focus on Mo(W)S(Se)$_2$. Few reports about the synthesis of monolayer tellurides and other 2D materials such as In_2Se_3 and so on. The tellurides and atomically thin transitional metal ditellurides like WTe_2 and $MoTe_2$ have triggered tremendous research interests because of their intrinsic nontrivial band structure. They are also predicted to be 2D topological insulators and type-II Weyl semimetals. Here, we demonstrate controlled synthesis of high-quality and atom-thin tellurides with lateral size over 300 μm. We found that the as-grown WTe_2 maintains two different stacking sequences in the bilayer, where the atomic structure of the stacking boundary is revealed by scanning transmission electron microscope (STEM). The low-temperature transport measurements revealed a novel semimetal-to-insulator transition in WTe_2 layers and an enhanced superconductivity in few-layer $MoTe_2$. This work paves the way to the synthesis of atom-thin 2D TMDs and also quantum spin Hall devices.

References

[1] Jiadong Zhou, Fucai Liu, Junhao Lin, Zheng Liu. Adv. Mater.,(2016). DOI:10.1002/adma.201603471
[2] Jiadong Zhou, Zheng Liu. *Nano Lett.*, 2015, 15 (10), pp 6400–6405

Figures

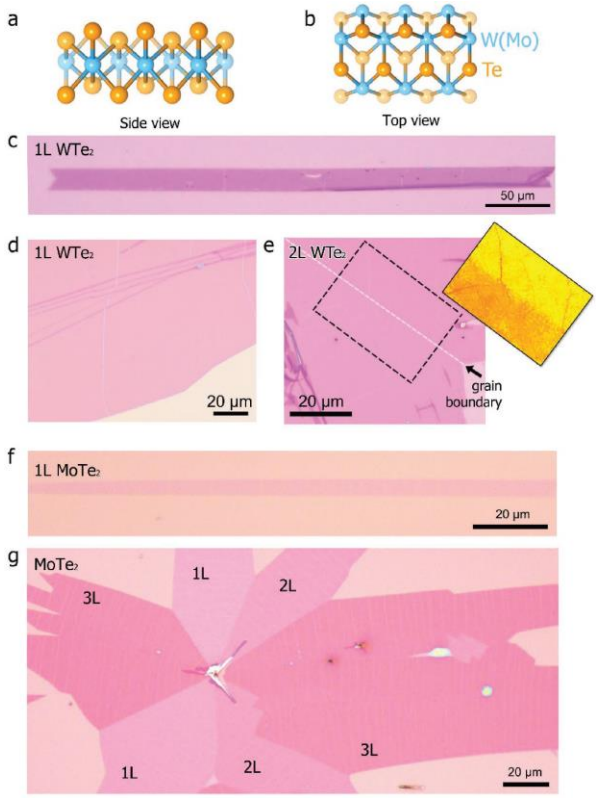

Figure 1: Optical geometries of WTe_2 and $MoTe_2$ monolayers

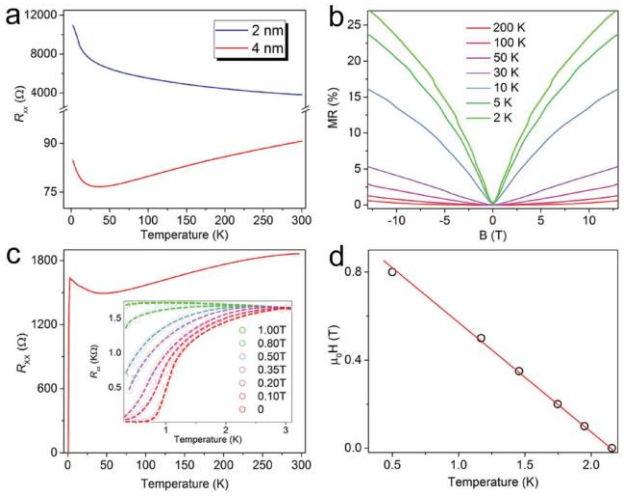

Figure 2: Transport in different thicknesses of WTe_2 and superconductivity in few layered $MoTe_2$