

Disorder engineering and conductivity dome in ReS₂ with polymer electrolyte gating

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Abstract

Atomically thin rhenium disulphide (ReS₂) is a member of the family of semiconducting two-dimensional materials. It has distorted 1T crystal structure, which leads to anisotropic transport and is characterized by weak interlayer coupling. Here, we report on the electrical transport study of mono- and multilayer ReS₂ in electrical double layer transistors (EDLT) configuration (Figure 1). We find that conductivity is completely suppressed at high carrier densities, an unusual feature, unique for monolayer ReS₂ (Figure 2). For multilayered flakes the effect is milder and insulator-metal-insulator sequence was observed. We use dual-gated devices to distinguish between the effects of doping and electrostatic disorder. Furthermore, we perform density functional theory (DFT) calculations and build a transport model, which qualitatively describes our findings [1].

References

- [1] Ovchinnikov, D. et al. Disorder engineering and conductivity dome in ReS₂ with electrolyte gating. Nat. Commun. 7:12391 doi: 10.1038/ncomms12391 (2016)

Figures

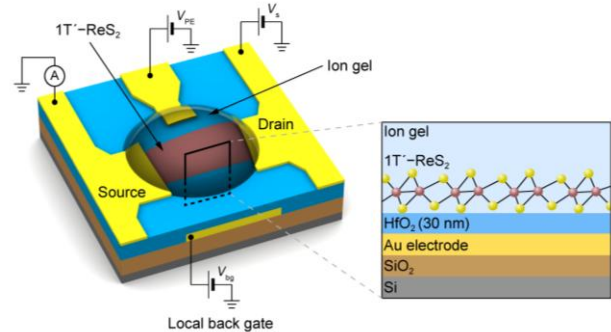


Figure 1: Schematic of EDLT based on ReS₂.

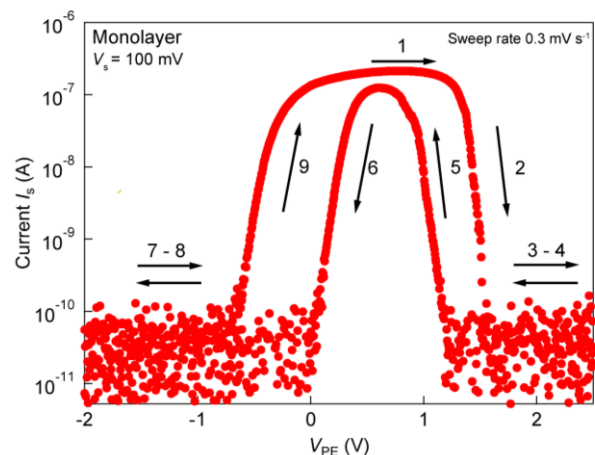


Figure 2: Gate sweep of EDLT based on monolayer ReS₂. Conductivity is completely suppressed at high carrier densities.