Supporting information

# Self-scrolling $MoS_2$ Metallic Wires

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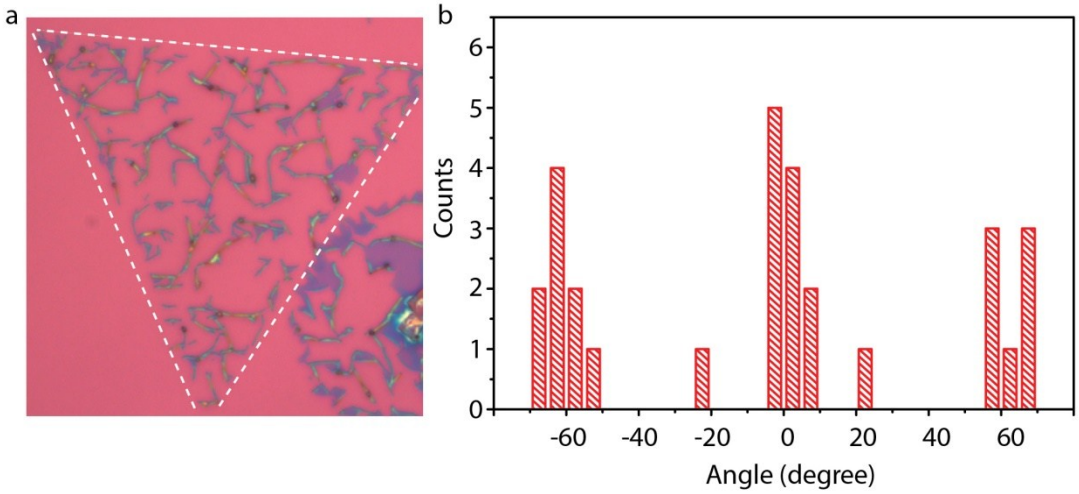


Figure S1. The histogram of $MoS_2$ nanoscroll direction reference to its edge. The $MoS_2$ nanoscrolls are formed from as-grown $MoS_2$. The larger interaction between $MoS_2$ film and substrate makes its break up during scrolling.

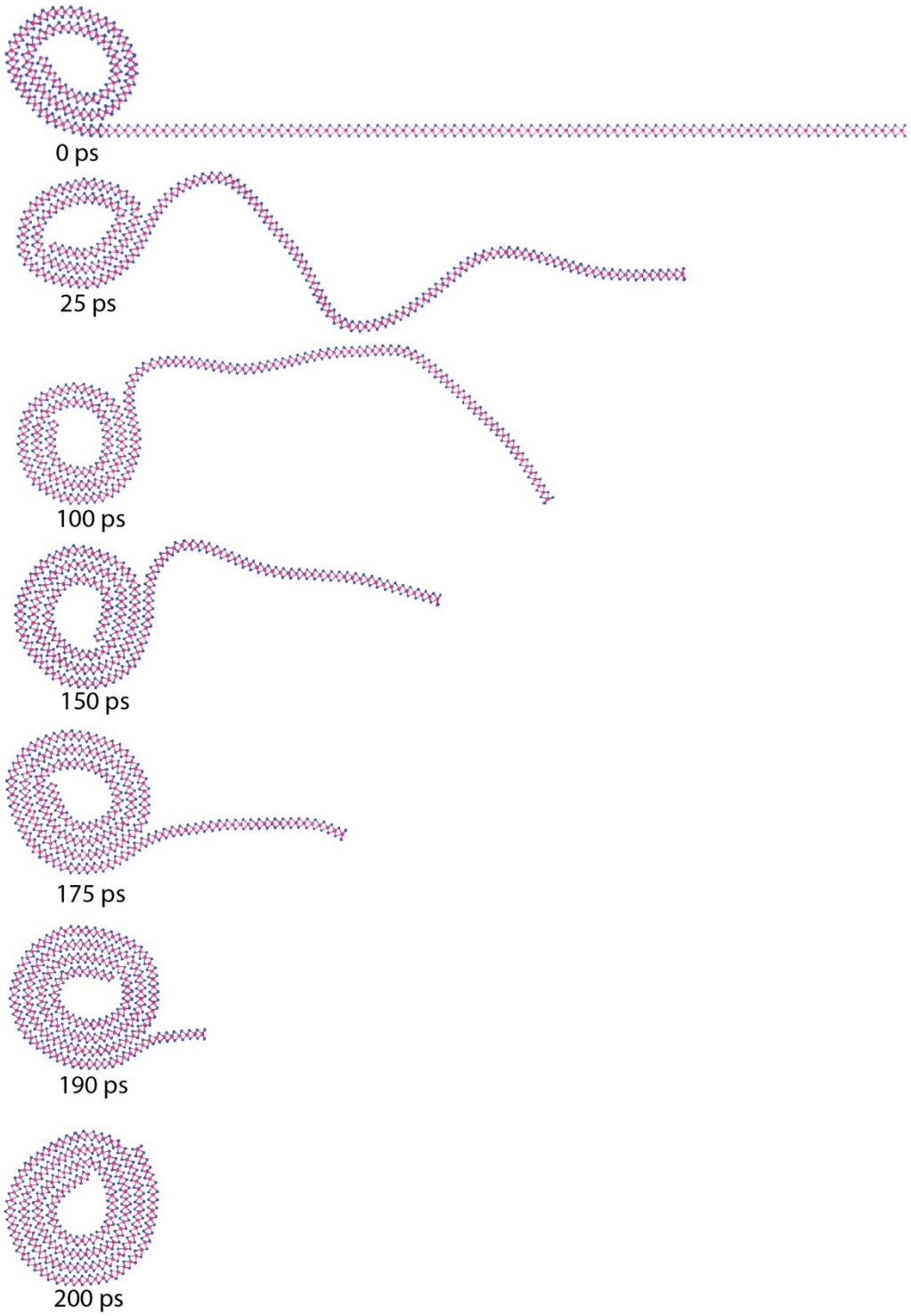


Figure S2. The detailed snapshots of $MoS_2$ sheet self-scrolling at time intervals from 0 to 200 ps.

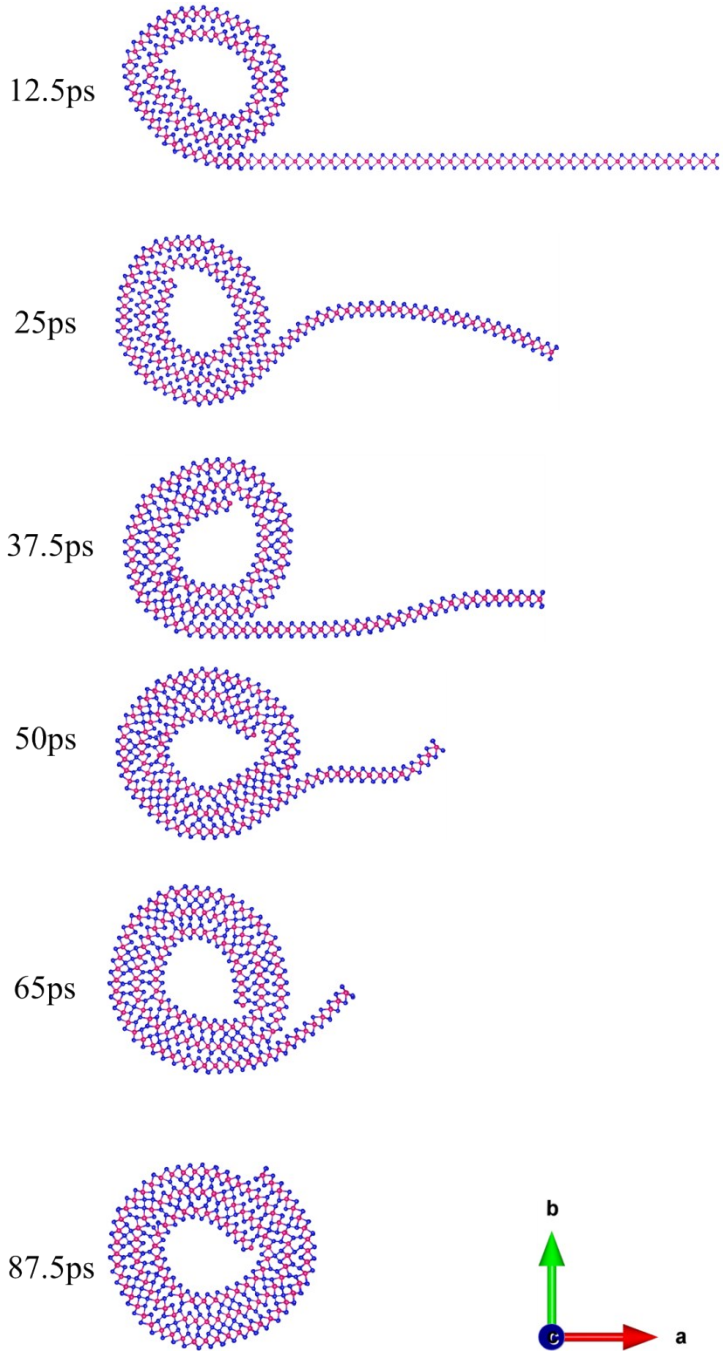


Figure S3. The detailed snapshots of a relatively shorter $MoS_2$ sheet self-scrolling at time intervals from 0 to 87.5 ps (see Supporting Vedio S2).

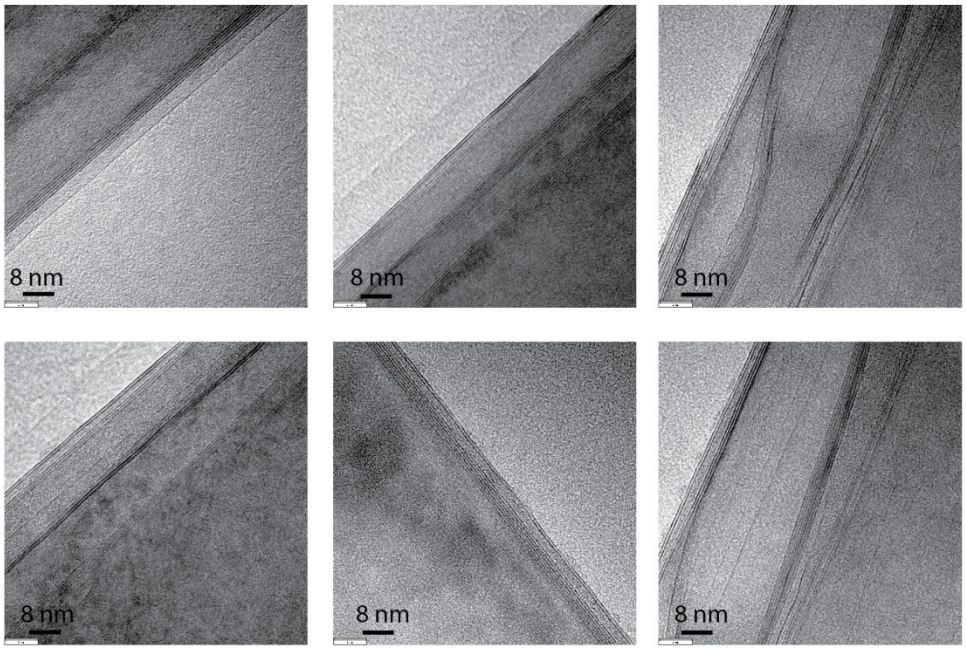


Figure S4. Other HRTEM image of $MoS_2$ nanoscroll.

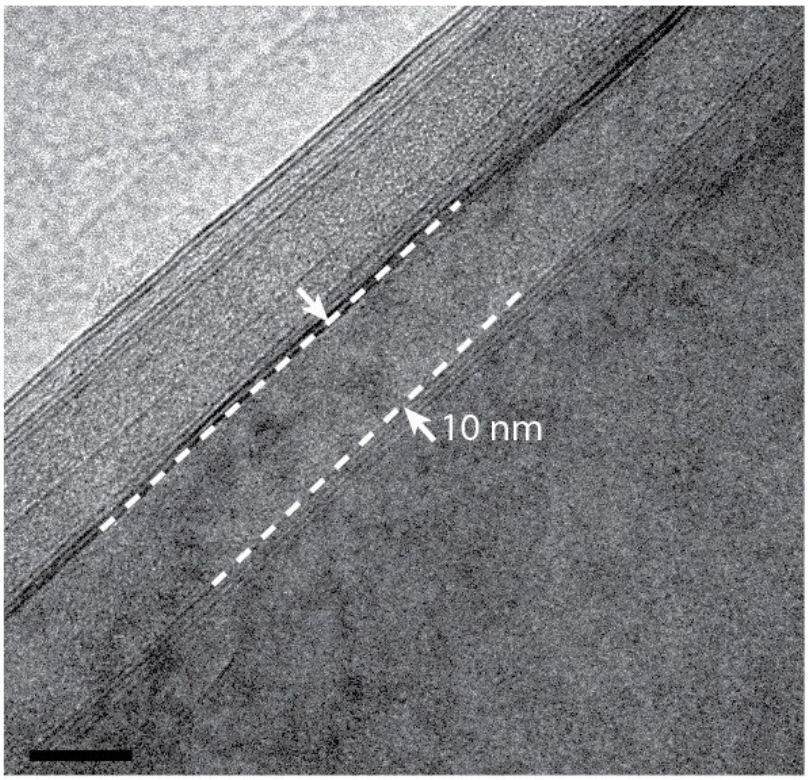


Figure S5. TEM image of $MoS_2$ nanoscroll with large interlayer distance. The scale bar is 10 nm.

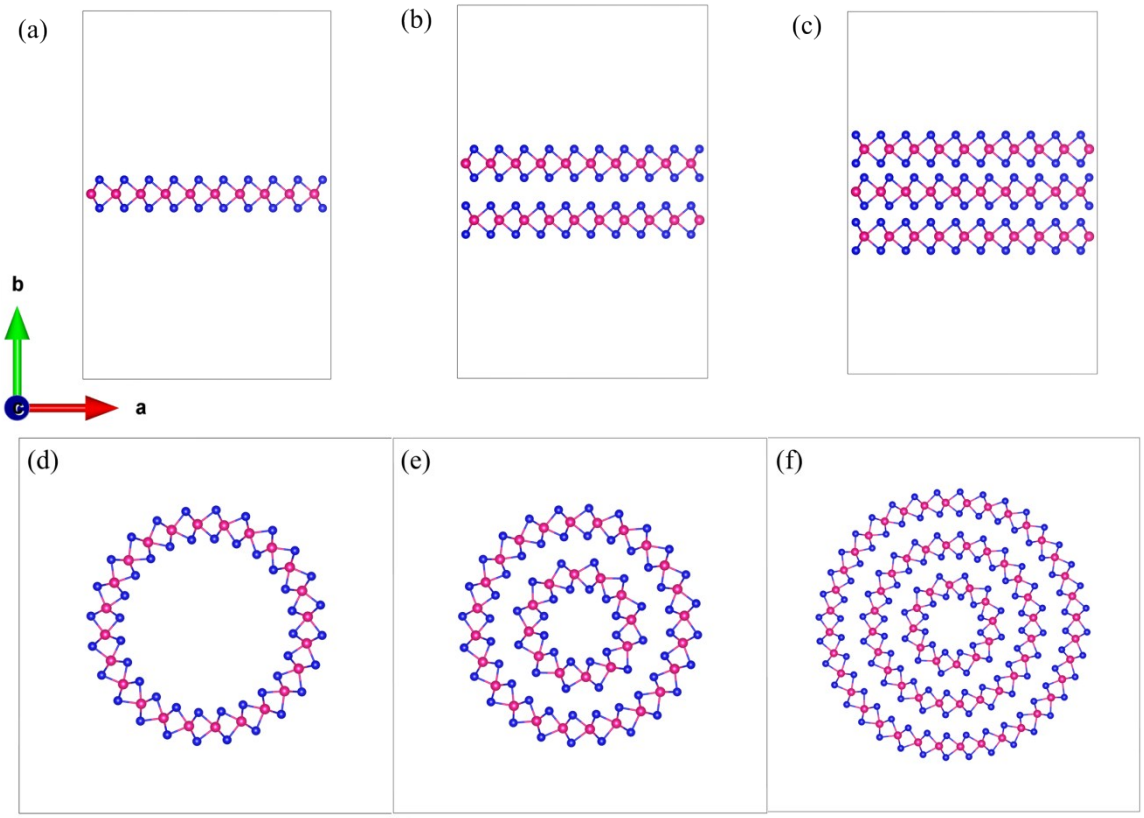


Figure S6. The optimized multi-layer (a) 1 layer, (b) 2 layer, (c) 3 layer $MoS_2$ sheet and the multi-walled nanotubes (d) (12, 12), (e) (6, 6)-(12, 12), (f) (6, 6)-(12, 12)-(18, 18).

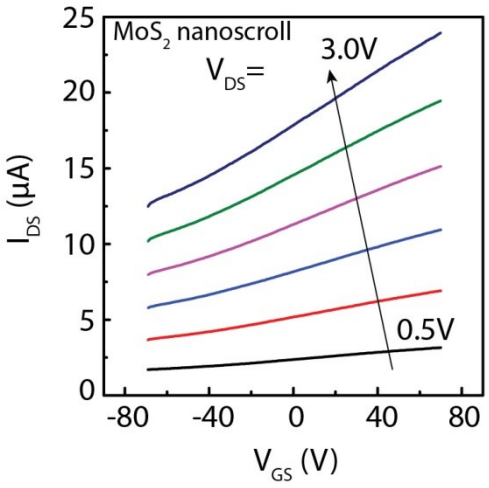


Figure S7. The transfer property of $MoS_2$ nanoscroll transistor under different source-drain voltage.

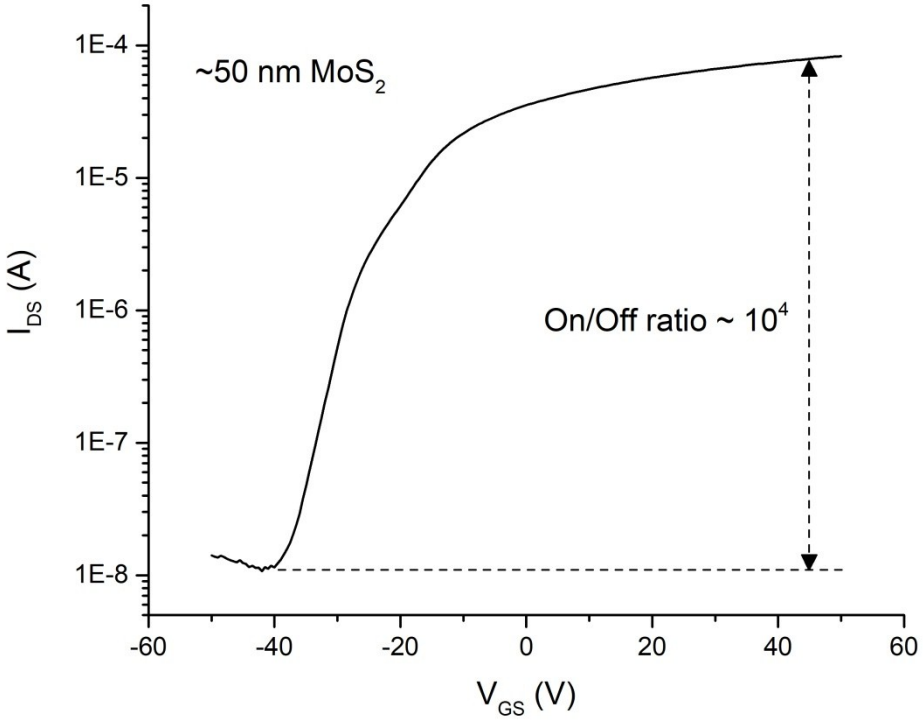


Figure S8. The transfer property of thick $MoS_2$ sheet with thickness of about 50 nm. Compared to the thick $MoS_2$ sheet, the lower on/off ratio in $MoS_2$ nanoscrolls device indicates that the difference transport behavior is originated from its unique structure (continually scrolling structure) rather than the increased thickness.

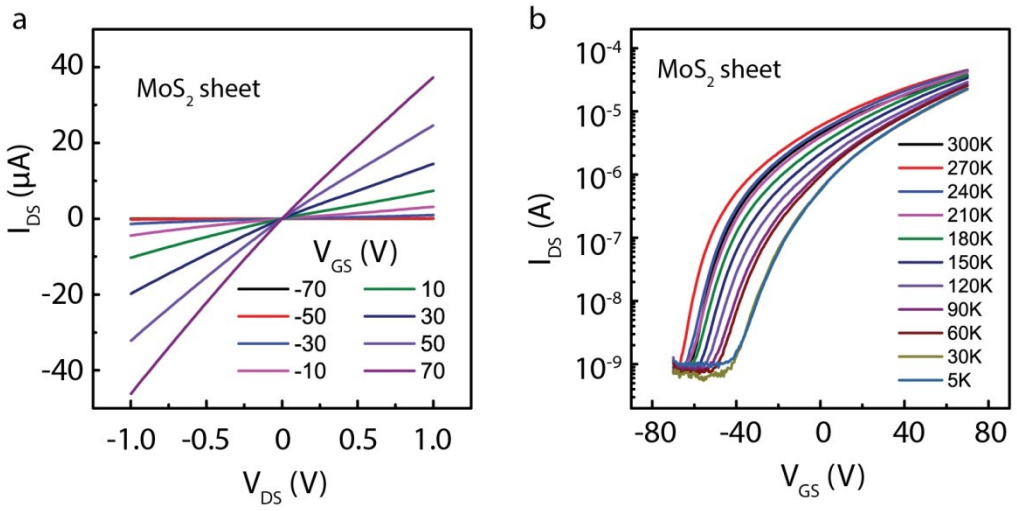


Figure S9. a) The output property of $MoS_2$ sheet transistor. b) The temperature dependent transfer curve of $MoS_2$ sheet transistor.

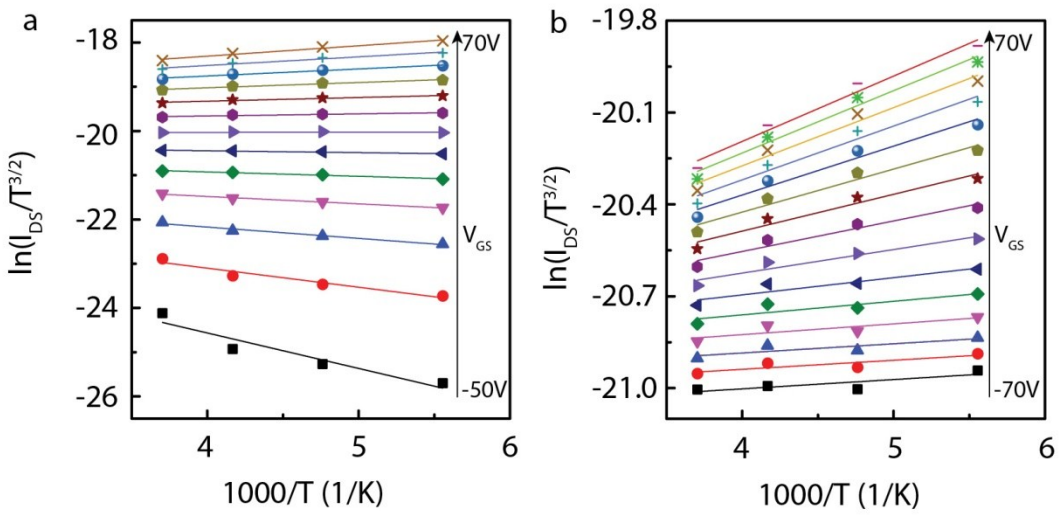


Figure S10. a) and b) The linear fit of $ln(I_{DS}/T^{\frac{3}{2}})\sim 1000/T$ on $MoS_2$ film and nanoscroll transistor, respectively.