

# Two-Dimensional MoS<sub>2</sub>/WS<sub>2</sub> Heterostructure Synthesized from WO<sub>3-x</sub>/MoO<sub>3-x</sub> Core-Shelled Nanowires

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## Abstract

Controlled stacking of different two-dimensional (2D) atomic layers will greatly expand the family of 2D materials and broaden their applications. Here we developed a novel approach for synthesizing MoS<sub>2</sub>/WS<sub>2</sub> heterostructures by chemical vapor deposition. The successful synthesis of pristine MoS<sub>2</sub>/WS<sub>2</sub> heterostructures is attributed to the usage of core-shelled WO<sub>3-x</sub>/MoO<sub>3-x</sub> nanowires as a precursor, which naturally ensures the sequential growth of MoS<sub>2</sub> and WS<sub>2</sub>. The obtained MoS<sub>2</sub>/WS<sub>2</sub> heterostructures exhibited high crystallinity and high mobility as evidenced by various microscopic, spectroscopic and electrical measurements. We also explored the selectivity and effects of the stacking orientation in the heterostructures and concluded that the difference in the bandgap of MoS<sub>2</sub>/WS<sub>2</sub> bilayers introduced by varied stacking configurations was very small. Our approach elucidates that the rational design of precursors can accurately control the growth of high quality 2D heterostructures and this approach can be extended to create versatile 2D TMDCs heterostructures by using various core-shelled nanomaterials synthesized during the past two decades as precursors.

## References

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## Figures

