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High-mobility three-atom-thick semiconducting films with wafer-scale homogeneity

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Monolayer Transition Metal Dichalcogenides

- Large scale sub-nanometer thick semiconducting film with high electrical performance for applications such as flexible electronics.
- Monolayer transition metal dichalcogenides (TMDs) exhibit novel properties such as valleytronics.



Convention device based on mechanical exfoliated material.



 \circ small scale Science 344, 1489 (2014) o complicated process

Metal-Organic Chemical Vapor Deposition

Well stitched grains

Batch Fabrication of High Performance Electronics Devices



Conclusions

- Homogeneous monolayer transition metal dichalcogenides films over 4 inch scale \checkmark
- ✓ High mobility at room temperature
- ✓ Intrinsic optical and electronic properties



References

This work is published in Nature **520**, 656 (2015)

2. Nature Mater. **12**, 815 (2013) 3. *Nano Lett.* **13**, 2640 (2013) 4. Phys. Rev. B 85, 115317 (2012) 5. *Nano Lett.* **13**, 4212 (2013)