

Min Sup Choi^{1,2}Younghun Jung¹, Ankur Nipane¹, Abhinandan Borah¹, Bumho Kim¹, Daniel Rhodes¹, Won Jong Yoo², James Hone¹, James Teherani¹¹Columbia University, New York, NY, USA, ²Sungkyunkwan University, Suwon, Koreamc3614@columbia.edu

Transferred via contacts for high quality 2D and hetero-structured devices

The semiconducting transition metal dichalcogenides (TMDCs) have been considered as a promising candidate for Si-based electronics. However, it is notorious particularly for a contact of semiconducting TMDCs especially when their thickness scales down to extreme thinness since fabrication processes such as polymer-based lithography and electron beam evaporation can contaminate and damage the semiconducting layers significantly. [1],[2] The technique of transferred contacts have been recently reported to minimize the damage and contact resistance.[1],[3] The availability of the technique to the various semiconducting TMDCs and its van der Waals (vdW) heterostructures have not been studied. In this study, we demonstrated the high-quality devices for various semiconducting TMDCs (MoS₂, MoTe₂, WSe₂) contacting with transferred via contacts (TVCs). The fabricated devices showed highly performed and reliable field effect transistor (FET) characteristics with comparatively low contact resistance. Moreover, the TVCs composed of different metals allow us to fabricate vdW hetero-structured devices such as MoS₂-WSe₂, as a high-quality p-n junction device revealing gate-tunable rectifying behavior. This study provides a promising way to discover an intrinsic property of 2D electronics and photonics.

References

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