Scalable synthesis of WS_2 on Graphene: an all 2D spintronic platform

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Abstract

By exhibiting a measurable bandgap and exotic valley physics, atomically-thick tungsten disulfide (WS_2) offers exciting prospects for optoelectronic applications. The synthesis of continuous WS_2 films on other two-dimensional (2D) materials would greatly facilitate the implementation of novel all-2D photoactive devices [1-3]. We have demonstrated the scalable growth of WS_2 on graphene via a chemical vapor deposition (CVD) approach. Spectroscopic and microscopic analysis reveal that the film is bilayer-thick, with local monolayer inclusions [4]. Photoluminescence measurements show a remarkable conservation of polarization at room temperature peaking 74% (Fig. 1-2) for the entire WS_2 film. Furthermore, we present a scalable approach for the synthesis of vertical Van der Waals heterostructures which show a clear epitaxial relation (Fig. 3), opening the route for a wafer scale production for optical spin-injection devices and polarization-resolved photodetectors [5].

References

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[3] Q. H. Wang, K. Kalantar-Zadeh, A. Kis, J. N. Coleman, M. S. Strano, Nature Nanotech. 7 (2012), 699–712

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Figures

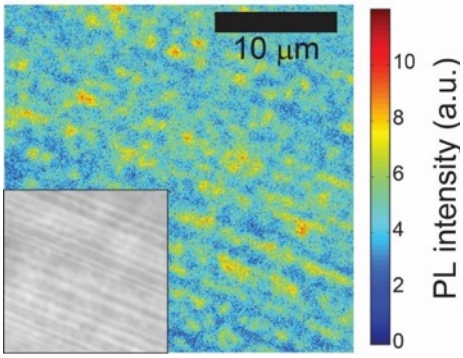

Figure 1: PL intensity map of on WS_2 on graphene. Intensity is higher on buffer layer (non quenching) areas.

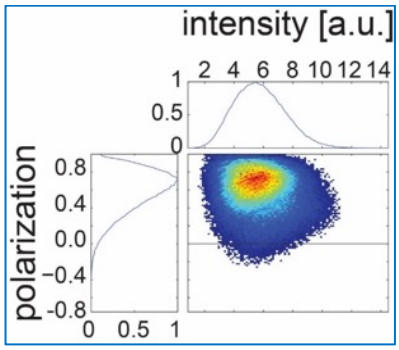

Figure 2: Intensity vs Polarization histogram. The conservation polarization peak is ~74%.

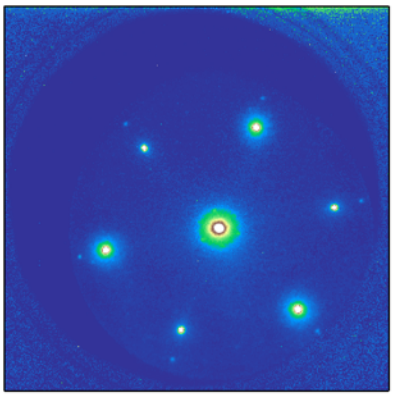

Figure 3: Low Energy Electron Diffraction pattern showing a clear epitaxial relation between WS2 and Gr.