Towards large area MoS_2/graphene heterostructures on silicon carbide

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Recently, the expanding role of silicon carbide (SiC) in energy efficient electronics motivated a resurgence of interest in large area integration of 2D materials with SiC for novel devices [1,2,3]. In this work, MoS_2/graphene heterojunctions have been obtained by MoS_2 CVD onto epitaxial graphene (EG) on SiC(0001). A multiscale investigation by complementary structural, spectroscopic and electrical characterization techniques allowed to evaluate the MoS_2 covered fraction, thickness uniformity and epitaxial quality of MoS_2 on EG, providing insights on the growth mechanisms. MoS_2 domains preferentially nucleate along the SiC steps (Fig.1(a)) and exhibit a high degree of orientation, as confirmed by cross sectional HRTEM analyses (Fig.1(b)) allowing to resolve Mo and S sublayers. This ultimately results in a MoS_2 film with low density of grain boundaries. Raman analyses (Fig.1(c,d)) provided information of the evolution of EG strain after MoS_2 growth. Finally, nanoscale current-voltage measurements by C-AFM (Fig.2(a)) showed the rectification behavior at the MoS_2/EG heterojunction, providing an insight on the current injection mechanisms across this van der Waals interface.
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References

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Figures

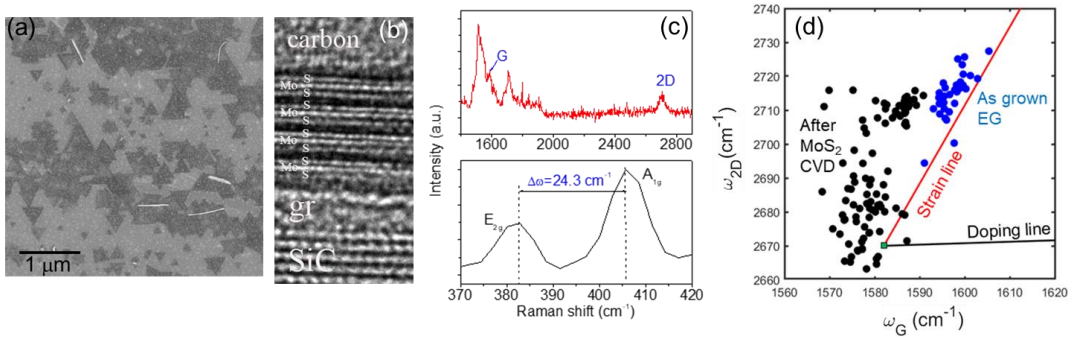

Figure 1: (a) SEM, (b) HRTEM and (c,d) Raman analysis of CVD MoS_2/EG heterostructures

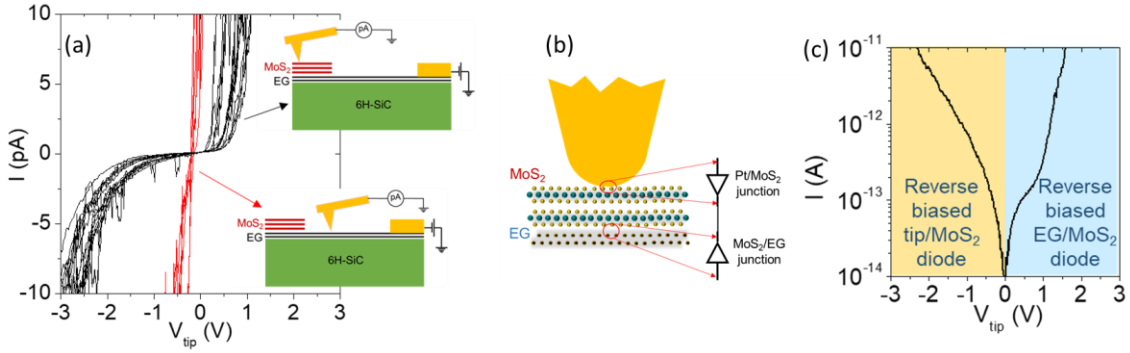

Figure 2: (a) I-V analyses and (b,c) description of current injection at MoS_2/EG junction.