Direct growth of graphene on MoS_2:
Towards Van der Waals heterostructures

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Heteroepitaxial growth of thin layers of semiconducting materials conforming heterostructures represent the main foundations of numerous modern devices. Recently, 2D materials combined into van der Waals multilayers have emerged as an appealing option to conform valuable heterostructures, without the typical interfacial lattice-matching constraints encountered in conventional heteroepitaxial growth. The usual fabrication of these Van der Waals heterostructures relies on transfer processes that frequently limit the production yield. Therefore, a scalable method to directly growth 2D materials heterostructures is a priority in this field. To face this challenge, recently we devised new protocols to growth graphene on semiconducting oxides (SiO_2, TiO_2) at low temperature by using plasma-CVD [1, 2]. Now, we are extending our approach to synthesize graphene on transition metal dichalcogenides (MoS_2) exploring the feasibility of direct synthesis of van der Waals heterostructures [3]. In this contribution, we present our last developed protocols. The graphene films are characterized in terms of morphology (AFM)(Fig.1), chemical structure and composition (Raman). The role of the carbon precursors (CH_4 & C_2H_2), gas diluents (H_2 & Ar), temperature and other synthesis parameters used on the final properties on the film structure is discussed. We identify the substrate activation as the main limiting factor to improve the material quality and propose a new strategy to overcome this drawback. The methodologies shown are intrinsically pure, easily scalable and represent a step forward in the direct growth of van der Waals heterostructures.

REFERENCES

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FIGURES

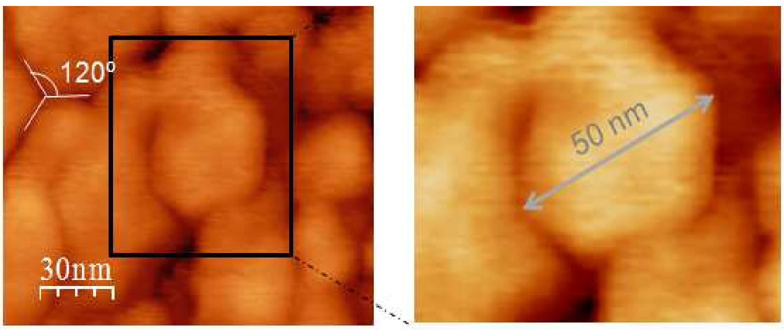

Figure 1: AFM images of graphene crystals (submonolayer coverage) grown on MoS_2.