Graphene and Beyond: Synthesis and Characterization of Atomic-Films

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The tremendous interest in 2D materials over the last decade is driven by their rich physics and device performance that hold great promise for future technological applications. The physical and chemical properties of these materials highly differ from their 3D counterpart. Therefore, the rational synthesis of atomic-films with the desired structure (number of layers, chemical composition, phase, etc.) is a critical prerequisite to fulfill the potential of materials.

In this talk, I will address the different approaches we have to grow atomic-thin materials and review recent advances in the growth and characterization of single- and few-layer van der Waals solids. I will focus on gas phase techniques, starting from graphene and hexagonal boron nitride (*h*-BN), throughout the transition metal dichalcogenides (TMDs) family and finalize with more exotic 2D materials. The similarities and differences between these materials and their respective growth mechanism will be discussed. For example, the growth of graphene and *h*-BN is considered to occur catalytically on transition metal surfaces [1,2, 3]. TMD growth, on the other hand, does not appear to be a catalytic process, therefore, opening the opportunity for their direct synthesis on arbitrary substrates [4]. The advantages and disadvantages of both growth-types will be elaborated. I will finalize by describing our attempts for the direct synthesis of 2D heterostructures and how they can be assembled into novel 3D structures.

References

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Figures

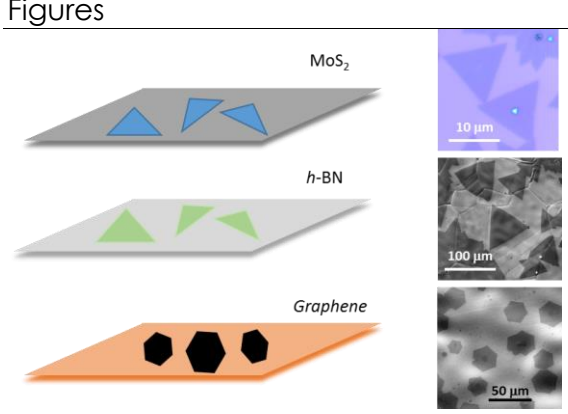

Figure 1: Chemical vapor deposition of different 2D materials.