Metalorganic Chemical Vapour Deposition of MoS_2

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Since the first controlled isolation of graphene, two-dimensional materials, especially transition metal dichalcogenides have gained increased attention due to their unique physical properties which make them particularly attractive for applications in flexible electronics. In order to produce homogenous thin-films with large-area uniformity suitable for electronics, a metalorganic chemical vapour deposition (MOCVD) method is used in this contribution. In this particular process, the precursors are metalorganic compounds ($Mo(CO)_6$ and $(C_2H_5)_2S$) which are stored separately from the growth chamber, allowing individual control of the precursor gas flows. This approach has been recently reported [1] but little is known about the growth mechanism.

In this work, we present a study of the MOCVD process in which we explore the growth parameters space: precursors and carrier gas flow, growth time, chamber temperature and pressure. The resulting thin layer MoS_2 specimens are characterized with a number of techniques, such as Raman spectroscopy, photoluminescence (PL), scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM); revealing uniform single layered MoS_2 films with an area of up to 4 cm^2.

References

[1] K. Kang, S. Xie, L. Huang, Y. Ham, P. Y. Huang, K. F. Mak, C. J. Kim, D. Muller, J. Park, Nature, 520 (2015) 656.

Figures

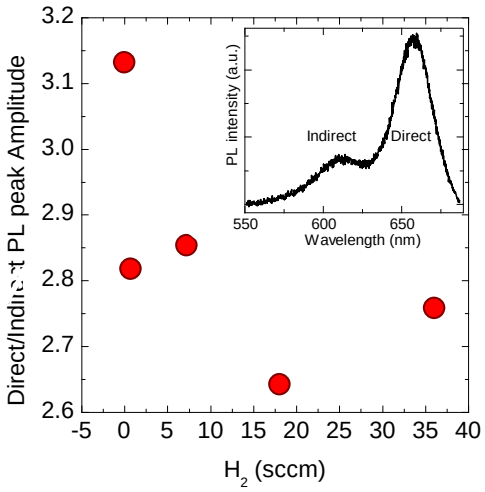

Figure 1: PL parameters (amplitude ratio between the direct and indirect peaks) evolution as a function of the H_2 flow. Inset: Characteristic PL spectrum of a MoS_2 thin film.

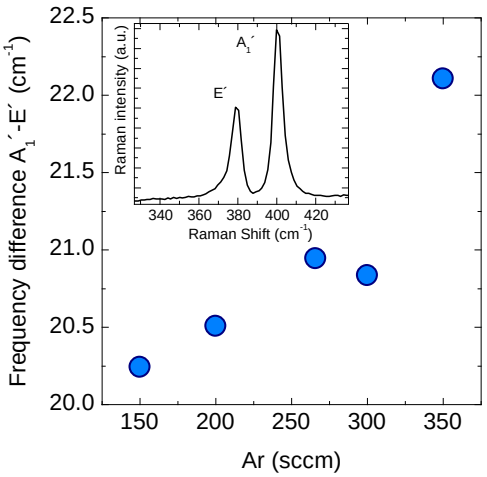

Figure 2: Raman parameters (frequency difference between the in-plane and out-of-plane vibrational modes) evolution as a function of the Ar flow. Inset: Characteristic Raman spectrum of a MoS_2 thin film.