Study of parameters for CVD growth of 2-dimensional MoS_2 by liquid phase molybdenum precursors

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Two-dimensional (2D) molybdenum disulfide is the most interesting transition metal dichalcogenide due to its peculiar optoelectronic properties [1].
Recent results [2, 3] indicate that molybdenum liquid precursors can provide major steps towards reliable and optimized Chemical Vapour deposition (CVD) growth of MoS_2 flakes [4]. In particular, the adoption of Mo precursors in the liquid phase contributed to a relevant success in growing large-area MoS_2 mono and few-layer flakes and to achieve a reproducible process.

We present the effect of CVD parameters on the growth of MoS_2 2D by considering different experimental conditions and by studying the final properties of 2D flakes. The different samples were analyzed with Scanning Electron Microscopy, Raman and Photoluminescence spectroscopy to evaluate the number of layers, the strain, the density of charge carriers and the crystalline quality.
We show that, by acting on the temperature in the growth reactor, the carrier gas flow rate, the relative quantities of precursors and the type of surfactant mixed with liquid phase molybdenum, it is possible to control with good reproducibility the number of layers, the average lateral size, the thickness, the morphology and the optical properties of the nanostructures.

We also describe a method to transfer MoS_2 flakes to different substrates and we discuss Aerosol Jet Printing of liquid precursors [5] as a technological step useful for device development.

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