Synthesis of MoS_2 by DLI-CVD – an effective technique for the homogeneous deposition of MoS_2 on Si/SiO_2

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Abstract

Since the first isolation of graphene, diverse 2D materials have been studied due to their remarkable properties. Among these, MoS_2 has many potential applications due to its semi-conductor nature with a direct band gap (for the isolated monolayer), allowing it to be used in next-generation optoelectronic and switching devices [1,2]. Classic synthesis of these materials is performed by chemical vapor deposition (CVD), which can produce flakes of the material [1,3,4]. However, challenges are still present for large scale applications, specially related to increasing flake size and density, as well as creating reproducible protocols for its synthesis [4]. We demonstrate a new method for MoS_2 synthesis through Direct Liquid Injection (DLI-CVD) [5], which results in an inch scale homogeneous deposit of MoS_2 on Si/SiO_2 substrates. Through modification of the parameters of the synthesis it was possible to control the thickness of the deposited layer. Complementary studies (reflectance, Raman and photoluminescence spectroscopies) indicate the success of the synthesis and the quality of the deposited layer. Especially, optimization of the thickness around the monolayer results in a photoluminescence (PL) yield of the same order of magnitude as the exfoliated monolayer (Figure 1). The ease of the synthesis and the possibility for large area deposition may lead to future applications of this method for example on the manufacturing of optoelectronic devices.

References

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Figures

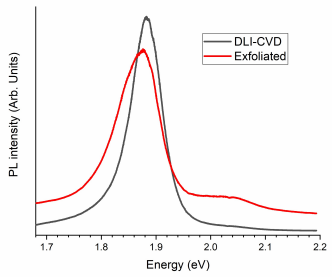

Figure 1: PL intensity of the MoS_2 obtained through DLI-CVD (black) compared to that of exfoliated 1L MoS_2 (red)