Contribution (Invited)

New trends in CVD methods for the synthesis of large-area bidimensional materials beyond graphene

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In the last years, an increasing interest in two dimensional materials beyond graphene is becoming apparent caused by the new possibilities of application that emerge from their outstanding electrical, optical and mechanical properties. In particular, most of the recent works in the field deal with issues as their band-gap tunning [1] and the tailored properties of heterostructures created by combining graphene, hexagonal boron nitride and/or transition metal dichalcogenides, (TDMCs) such as molybdenum disulfide or diselenide [2].

Up to the date, mechanical exfoliation has been the most widely used technique to obtain these heterostructures, presenting problems as poor repeatability, low throughput and high cost, which hinder the scalability of the process, being the synthesis of these materials with large area homogeneity a major challenge.

To overcome those problems, chemical vapor deposition has been repeatedly proposed for the synthesis of two-dimensional materials beyond graphene (see, for example [3]), given that it is a well established technique for the obtaining of the last. However, adapting this well-known method for the synthesis of other two-dimensional materials is not trivial, and often will require the modification of the systems employed to carry out the CVD growth.

Our aim is to review the main current challenges to grow these 2d materials by means of CVD, as well as the solutions proposed by Graphene Square Inc. to overcome them, which have been taken into account in the design of brand new scientific equipment optimized for this task.

Specifically, the custom-designed models which appear in Figure 1 will be presented, optimized for the synthesis of graphene, h-BN and TMDCs from chip to wafer-scale on various substrates by using gas-phase or solid precursors and metal organic sources.

References

[1] Q. Ma et al., ACS Nano, **8** (2014) 4672

[2] X. Wang, F. Xia, Nature Materials, **14** (2015) 264

[3] Y. Lee et al., Nanoscale, **6** (2014) 2821

Figures

Figure 1: TCVD-RF100CA and TCVD-DC100CA for the synthesis of graphene, h-BN and TMDCs.