

Towards large-area growth of 2D materials by Direct Liquid Injection Chemical Vapor Deposition (DLI-CVD)

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The isolation of graphene has sparked considerable interest from both academic and industrial players around vast new possibilities offered by 2D materials. This class of materials, as their name suggests, are formed of a stacking of 2D layers weakly-bonded to one another, which properties tend to dramatically change when their thickness is reduced to a monolayer [1]. These effects have been investigated extensively and while they show great promise, industrial scaling remains challenging [2]. In this talk, the Chemical Vapor Deposition (CVD) growth of monolayer graphene, molybdenum and tungsten disulfide (MoS_2 and WS_2) and boron nitride (BN) will be tackled with large-scale introduction in mind. Emphasis will be put on the degree of control and detection needed and displayed in Annealsys machines to ensure batch-to-batch reproducibility. In particular, catalyst-assisted CVD and SiC sublimation growth for graphene, Direct Liquid Injection MOCVD (DLI-MOCVD) and DLI-ALD of MoS_2 and WS_2 monolayer, as well as CVD of hexagonal and amorphous boron nitride (hBN and aBN) will be presented. Direct liquid injection (DLI) is a type of precursor delivery that uses liquids as delivery agent [3]. This way, a large variety of liquid and solid precursors can be used in CVD while remaining safely stored at ambient temperature (Figure 1). Furthermore, the feeding rate can be precisely monitored and controlled using fast injectors allowing for very precise tuning of vapor stoichiometry in the reaction chamber.

References

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- [2] Zhong Lin, Amber McCreary, Natalie Briggs, Shruti Subramanian, Kehao Zhang, Yifan Sun, Xufan Li, Nicholas J Borys, Hongtao Yuan, Susan K Fullerton-Shirey, *2D Materials*, 3 (2016)
- [3] Vincent Astié, Cyril Millon, Jean-Manuel Decams, Ausrine Bartasyte, *IntechOpen*, (2018)

Figures

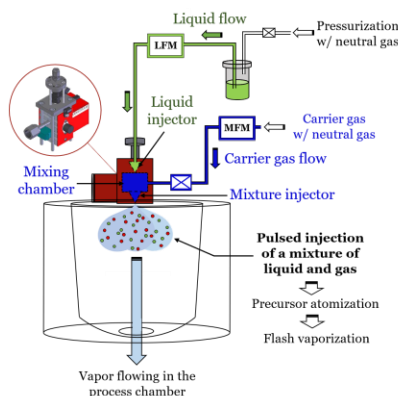


Figure 1: Schematic representation of KEMSTREAM's two-stage DLI system