The synthesis of two-dimensional transition metal dichalcogenide by cold-wall chemical vapour deposition

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Abstract

The synthesis of monolayer transition-metal dichalcogenides (TMDCs) by conventional hot-walled CVD remains critical issues of large-scale, spatial homogeneity and quality [1]. Here we demonstrate a cold-wall CVD (CW-CVD) system with advanced functions for the growth of high-quality wafer-scale homogeneous monolayer molybdenum disulphide (MoS_2) on various substrates [2]. This automatic system can precisely control the temperatures of multi-zone, pressure and gaseous flow rate with individual precursors of $Mo(CO)_6$ and sulfur. In addition, the system has high flexibility to be upgraded for extra functions such as plasma source, multi-precursor supply and load-lock system. The Raman spectrum of as-synthesized MoS_2 on 2-inch sapphire wafer shows the significant E^1_{2g} and A_{1g} peaks with 19cm^{-1} inter-distance, and the photoluminescence (PL) spectrum shows an apparent peak at 650 nm. Both spectra reveal the monolayer and high quality feature of CW-CVD synthesized MoS_2.

References

[1] Lee, Y.-H.; Zhang, X.-Q.; Zhang, W.; Chang, M.-T.; Lin, C.-T.; Chang, K.-D.; Yu, Y.-C.; Wang, J. T.-W.; Chang, C.-S.; Li, L.-J.; Lin, T.-W. *Advanced Materials* **2012,** 24, (17), 2320-2325.

[2] Kang, K.; Xie, S.; Huang, L.; Han, Y.; Huang, P. Y.; Mak, K. F.; Kim, C.-J.; Muller, D.; Park, J., *Nature* **2015,** *520* (7549), 656-660.

Figures

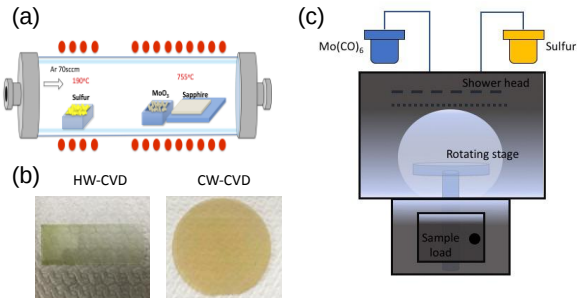

Figure 1 (a) Schematic diagram of the configuration of conventional HW-CVD. (b) The OM-image of the comparison between samples produced by HW- and CW-CVD (c) CW-CVD system with individual precursors supply.

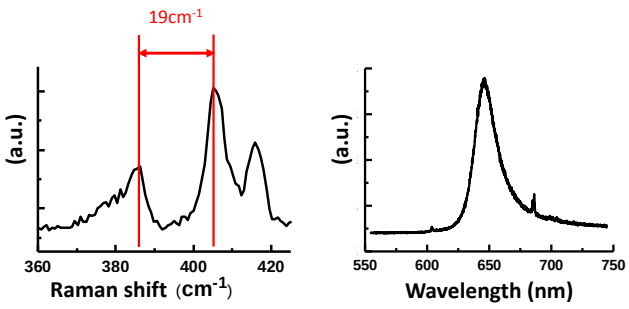

Figure 2 The Raman and PL spectra of monolayer MoS_2.