Synthesis of Large-Area and Highly Crystalline InS Atomic Layers on Insulating Substrates

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Abstract

Group-III monochalcogenides of two-dimensional (2D) layered materials have attracted widespread attention among scientists due to their unique electronic performance and interesting chemical and physical properties.[1] However, studies on the synthesis of highly crystalline, large-area, and atomically thin-film Indium sulfide (InS) have not been reported thus far. Here, we reported the chemical vapor deposition (CVD) synthesis method of atomic InS crystals on the insulating substrates.[2] The direct chemical vapour phase reaction of metal oxides with chalcogen precursors to produce a large-sized hexagonal crystal structure and atomic-thickness InS flakes or films on the mica. The ion-gel gated InS field-effect transistors (FETs) reveal n-type transport behavior, and have an on-off current ratio of > 10^3 and a room-temperature electron mobility of ~ 2 cm^2/Vs. Moreover, our CVD InS can be transferred from mica to any substrates, so various 2D materials can be reassembled into vertically stacked heterostructures.

References

[1] Han-Ching Chang, Chien-Liang Tu, Kuang-I Lin, Jiang Pu, Taishi Takenobu, Chien-Nan Hsiao, Chang-Hsiao Chen*, Small, 14 (2018) 1802351.
[2] Chien-Liang Tu, Kuang-I Lin, Jiang Pu, Tsai-Fu Chung, Chien-Nan Hsiao, An-Ci Huang, Jer-Ren Yang, Taishi Takenobu, Chang-Hsiao Chen*, Nanoscale, 12 (2020) 9366-9374.

Figures

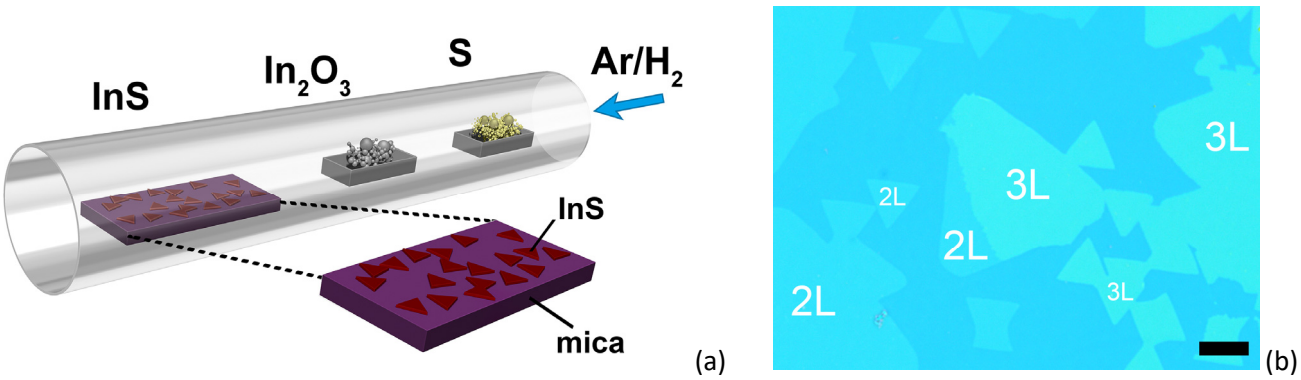

Figure 1: (a) Schematic diagram of the experimental setup for CVD synthesis of InS atomic layers, (b) OM image of trilayer InS grown on certain of those bilayer tops. Scale bar, 10 μm.