Record CVD Graphene mobility on Large Area and Scalable CVD Grown hexagonal Boron Nitride

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Abstract

In this work, we have demonstrated controlled growth of h-BN via supersaturation variation to achieve a high-quality interface for graphene devices. We demonstrate control over layer thickness from 50 nm to a monolayer for the same growth time. Within a monolayer, we show control that can yield isolated single crystal islands to fully coalesced polycrystalline layers with 15-micron grain sizes. An increase in supersaturation results in a bilayer formation, and eventually vertical growth resulting in multilayer bulk films in the same time frames. This transition is due to a faster increase in the rate of 2-D nucleation - it has an exponential dependence than edge velocity-rough edges which have a linear dependence - with supersaturation. We also engineer 5 order reduction in density of unwanted by-product that is n-BN resulting in improvement of the interface quality. Growth on up to 6-inch square Cu and transfer on to 4" Si/SIO2 substrate demonstrate the uniformity and scalability of the growth process. The demonstration of CVD graphene FETs on the synthesized CVD h-BN with state-of-the-art mobilities, 28000 cm2/V-sec at ambient room temperature conditions, along with better transport characteristics on several fronts as compared to Graphene/SiO2 validate the quality of the synthesized layers and quality of the process developed.

References

[1] Wang L., et al., Nature, 570 (2019) 91-95

Figures

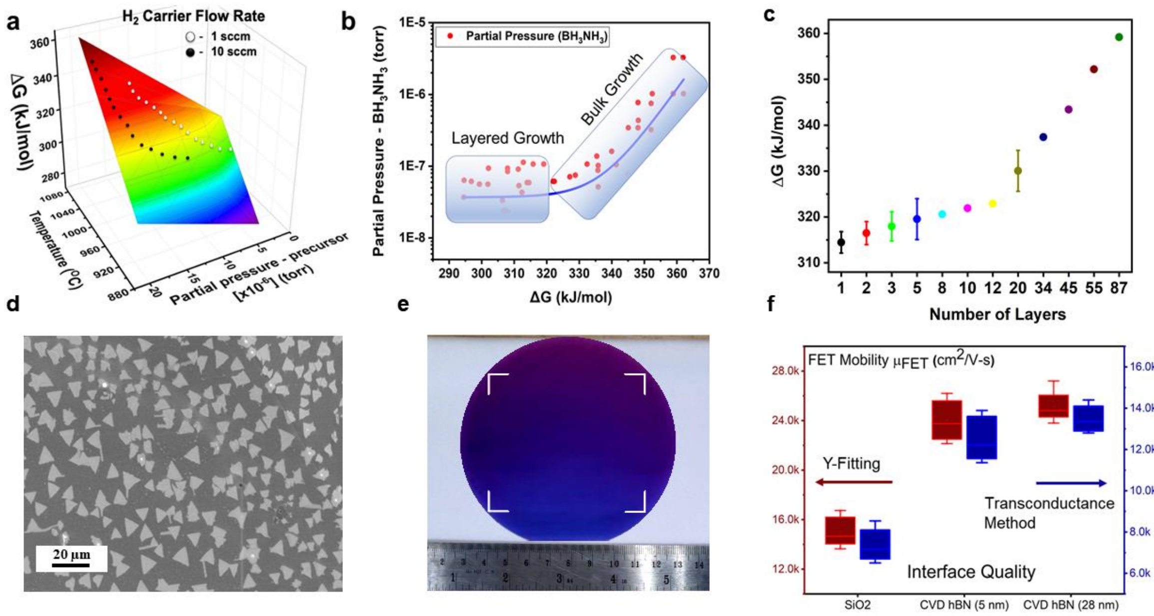

Figure 1: a) Thermodynamic window established for h-BN growth via CVD. b),c) Effect of inlet supersaturation on the type of growth and number of layers of h-BN obtained. d) 15µm sized monolayer triangles grown via supersaturation control. e) Large area h-BN grown via the demonstrated scalable process and transferred onto Si/SiO2 substrate. f) Record high CVD graphene FET mobility on CVD h-BN at ambient conditions.