

Controllable synthesis of large monolayer and multilayer graphene crystals
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Abstract

Chemical vapor deposition (CVD) synthesis of monolayer graphene on copper foil has been intensively studied during last few years. In order to match or exceed the quality of exfoliated graphene, the most important strategies are to make the graphene domains as large as possible and to prevent charge scattering from the substrate.

Here we report a controllable and scalable method (with well-defined conditions in a homemade CVD furnace) to achieve graphene single layer crystals over 500 μm in diameter. The nucleation density was reduced to less than 1 per square millimeter, and shape of graphene crystals is analogous to hexagonal snow crystals. Transport measurement of single layer CVD graphene on a boron nitride substrate at 4K shows mobility up to 50,000 cm^2/Vs . Furthermore, magnetic focusing between neighboring contacts has been observed as shown in Fig. 1, which demonstrates ballistic transport up to 1 μm for the first time in CVD graphene [1]. These measurements demonstrate a promising potential of CVD graphene for fundamental physics research.

The growth of bi-and trilayer graphene over 30 μm is also reported. The outline of the second and third layer is almost a perfect hexagon as shown in Fig. 2. The interaction between the various layers in the graphene and the interaction with the copper substrate will be discussed. Based on this work, we see no limits to the size or number of layers for monocrystalline graphene grown by CVD.

References

[1] Thiti Taychatanapat et al. Electrically tunable transverse magnetic focusing in graphene. Nature Physics, 2013, in press.

Figures

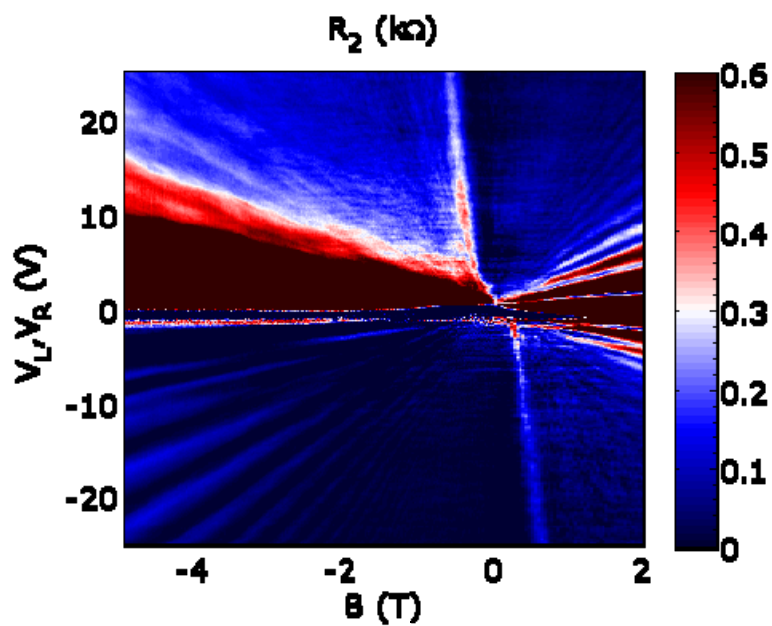


Figure 1, Transverse magnetic focusing measurement in monolayer graphene at 4K.

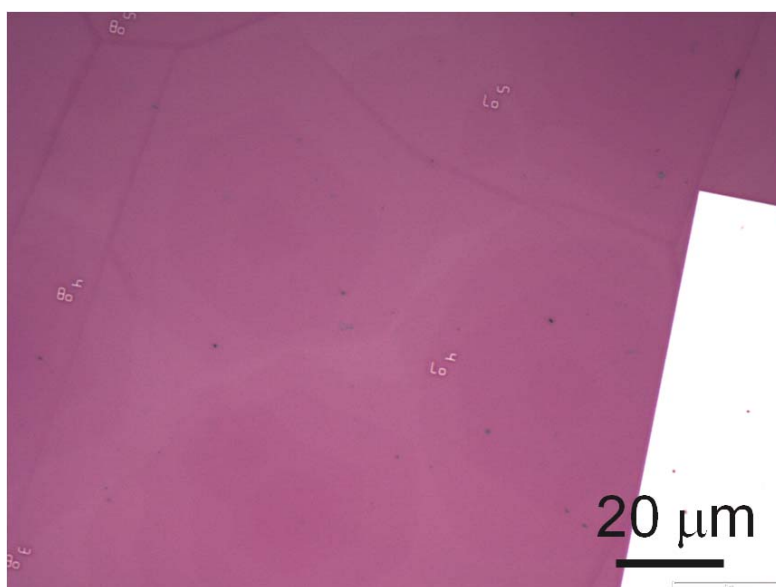


Figure 2, Hexagonal CVD multilayer graphene transfer onto SiO₂ substrate.