Identification and controlled alignment of ABC-trilayer graphene moiré superlattices for strongly correlated states

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Abstract: ABC-stacked trilayer graphene/hexagonal boron nitride (ABC TLG/hBN) moiré superlattice has emerged as a perfect platform for studying flat bands and strong many-body effects, such as correlated insulating states [1], superconductivity [2], and ferromagnetism [3]. However, the controlled alignment between TLG and hBN is challenging due to the random nature of the edge chirality. Moreover, the lack of identification in alignment between TLG and hBN is another obstacle. Here, we report a systematic technique to solve the challenges encountered in TLG/hBN moiré superlattice and provide a reliable way to identify the twist angle between ABC TLG and hBN. First, based on our newly reported technique [4], we control the alignment between ABC TLG and hBN by using the neighbour monolayer graphene as a reference. Second, we find the Raman integration function can be used to identify the ABA and ABC phases better than the traditional Raman 2D peak width [5]. Third, we find the evidence of Raman signature that can be used to directly identify the TLG/hBN moiré superlattice. Finally, we observe the correlated insulating states in our TLG/hBN moiré superlattice, further supporting the reliability of our reported technique. This work is supported by the MOE Singapore Tier 2 Grant No. MOE-T2EP50120-0015.

References

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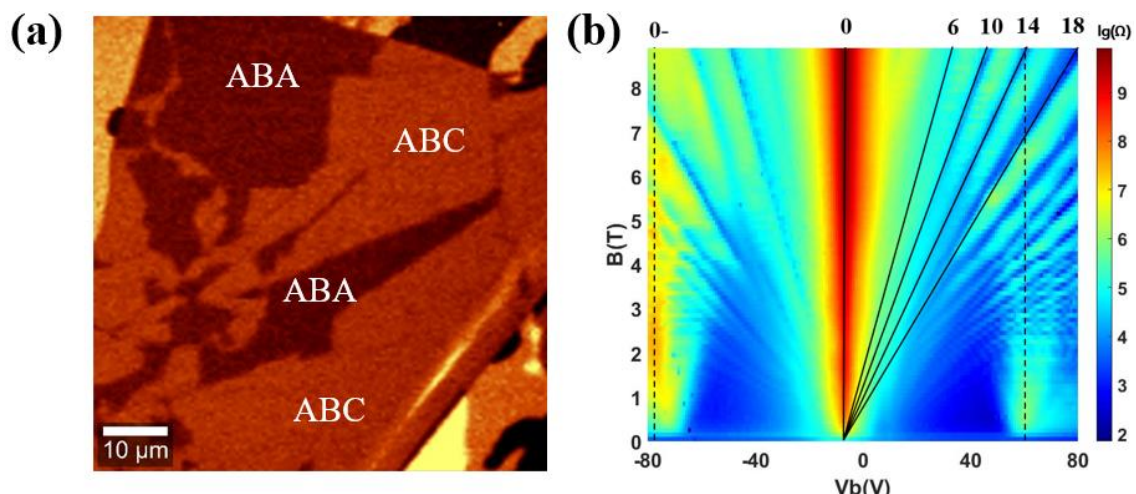[5] Cong, C., et al. ACS Nano, 2011, 5(11): 8760-8768.

Figures

Figure 1(a): Raman mapping of trilayer graphene area by integration function of G peak. The dark brown area represents ABA stacking order, and the orange area represents ABC stacking order. **1(b):** LL fan diagram of ABC TLG/hBN moiré superlattice. The quantum Hall states at filling factors = 6, 10, 14, 18…confirm the ABC stacking order in the TLG device.