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Folded Optical Phonons in Twisted Bilayer Graphene: Raman Signature of Graphene Superlattices YANAN WANG, ZHIHUA SU, Dept of Electrical and Computer Engineering, University of Houston, WEI WU, SIRUI XING, Center for Advanced Materials and Dept of Electrical and Computer Engineering, University of Houston, XIAOXIANG LU, Dept of Electrical and Computer Engineering, University of Houston, XINGHUA LU, Institute of Physics, Chinese Academy of Sciences, China, SHIN-SHEM PEI, Center for Advanced Materials and Dept of Electrical and Computer Engineering, University of Houston, FRANCISCO ROBLES-HERNANDEZ, College of Engineering Technology, University of Houston, VIKTOR HADJIEV, Texas Center for Superconductivity and Dept of Mechanical Engineering, University of Houston, JIMING BAO, Dept of Electrical and Computer Engineering, University of Houston — In contrast to Bernal-stacked graphene exfoliated from HOPG, twisted bilayer graphene are widely observed in the samples prepared by silicon sublimation of SiC or chemical vapor deposition (CVD). However, many of its basic properties still remain unrevealed. In this work, hexagon-shaped bilayer graphene islands synthesized by CVD method were systematically studied using Raman spectroscopy. A series of folded phonons were observed in the range from 1375 cm^{-1} to 1525 cm^{-1}. The frequency of folded phonon modes doesn't shift with laser excitation energy, but it is highly dependent on the rotational angle between two layers. In general, the frequency of folded phonon decreases with the increase of rotation angle. This rotation dependence can be qualitatively explained by the folding of phonon dispersion curve of single layer graphene into the reduced Brillouin zone of bilayer superlattice. The obseravtion of folded phonon is an important indication of superlattice band structure.

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