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Orientation-independent conductance step of graphene nanoribbons JI-HAE CHOI, SANG-HOON LEE, MINSOO KIM, Pohang Univ of Sci Tech, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, HU-JONG LEE, SEUNG-HOON JHI, Pohang Univ of Sci Tech, CNPL TEAM, QTSL TEAM, ULTRA-HIGH PRESSURE PROCESSES GROUP TEAM — Low-energy electronic structure of graphene is characterized by the states from two inequivalent valleys at K and K' points that have opposite chirality. In graphene nanoribbons (GNRs), the K and K' valleys, when projected into one-dimensional (1D) Brillouin zone, can be mixed due to the edge termination. The degree of mixing determines the electronic property of GNRs. However, non-valley mixing properties have been hardly observed so far. In this work, we made effective 1D transport channels by gate-defined carrier guiding. They exhibit a quantum conductance step of 4e2/h, which is the characteristic of non-mixed valleys. To verify these experimental results, we performed both first-principles and tight-binding calculations of GNRs with arbitrary axial orientations. Calculated band structures and quantum conductance of GNRs show zero-energy flat bands and a conductance step of 4e2/h except armchair-edge GNRs. We find that this is a consequence of generic zigzag-type boundary conditions of GNRs with arbitrary axial orientations except armchair-edge cases

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