Pseudomagnetic field engineering in graphene on GaN nanowires

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The engineering of pseudomagnetic fields in graphene is intensively investigated due to the application in field-based devices like spin filters [1]. Our recent work underlines the usefulness of GaN nanowire substrates for the induction of pseudomagnetic fields [2]. Samples of two-layer graphene on GaN nanowires (NWs) with different inter distances between supporting regions were characterized by HybriD mode AFM, Raman spectroscopy, and contactless transport [2]. In HybriD mode AFM, changes in local strain are reflected in the susceptibility of graphene to elastic deformation. Analysis of the measured deformation enabled a precise mapping of strain related to the non-uniform elongation of graphene (Fig. 1a). An increase of inter distances is correlated with an increase in the deformation of suspended graphene regions and strain. This result is confirmed by contactless transport measurements of weak localization [3]. The observed reduction of coherence scattering length (L_φ) and intervalley scattering length (L_i) with increasing strain gradient (Fig. 1b inset) show that strain-induced wrinkles can generate a pseudomagnetic field. This result is also confirmed by a substantial increase of the D' band intensity in the Raman spectrum (Fig. 1b).

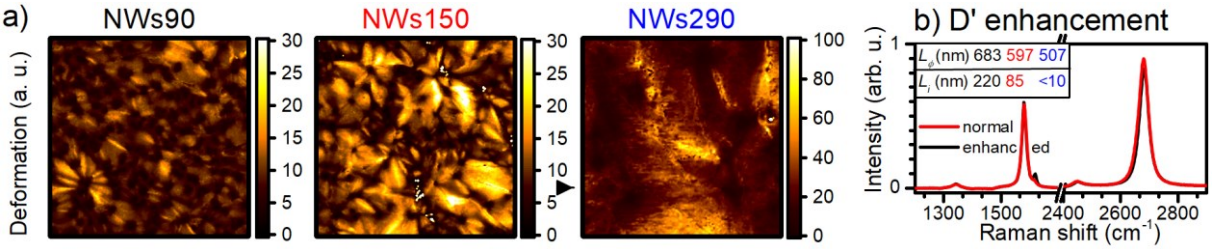

Figure 1. a) measured deformation of graphene on NWs characterized by different inter distances between supporting regions, note that scale in NWs290 differs, b) Raman spectra with normal and enhanced D' band, inset presents scattering lengths from weak localization.

The presence of spectra characterized by a ratio of D' to D larger than 0.77 is evidence of the occurrence of pseudomagnetic fields [4]. Our results show that the induction of pseudomagnetic fields in graphene on NWs is positively correlated with interdistances between NWs which allow us to control the induction of these fields.

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