Periodic modification of graphene via strain-induced localized reaction

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Abstract

Chemical modification has been regarded as an efficient and scalable method to tune the band structure of graphene. Because of the high energy barrier of the reaction, only a few species with high reactivity could react with graphene. Furthermore, these species react randomly with graphene and/or damage the main structure of graphene, potentially lowering the electrical properties. Thus, a new method for gaining selective modification of graphene in a controllable way is desirable.

Here, we reported a controllable method to realize periodic chemical modification of graphene via the strain-induced localized reactivity. Experiments proved that graphene with the higher compress strain showed a higher reactivity. This fact was further strengthened by the DFT simulation which demonstrated that the energy barrier of the strained area was much lower than that of the flat area. Therefore, we developed an approach to introduce a periodic strain by transferring CVD-grown graphene onto a substrate with designed periodic patterns. Comprehensive characterizations including SEM, Raman spectroscopy, AFM and EFM confirmed that periodic modification was achieved after chemical reaction.

To summarize, an efficient method to control periodic modification of graphene via the strain-induced localized reactivity was reported here. This method obviously provides a controllable approach to modify graphene, which opens up an avenue of applications toward functional optoelectronic devices and sensors.

References

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[2] A. K. Geim; K. S. Novoselov; et al. *Science,* **323** *(*2009), 610-613.

Figures

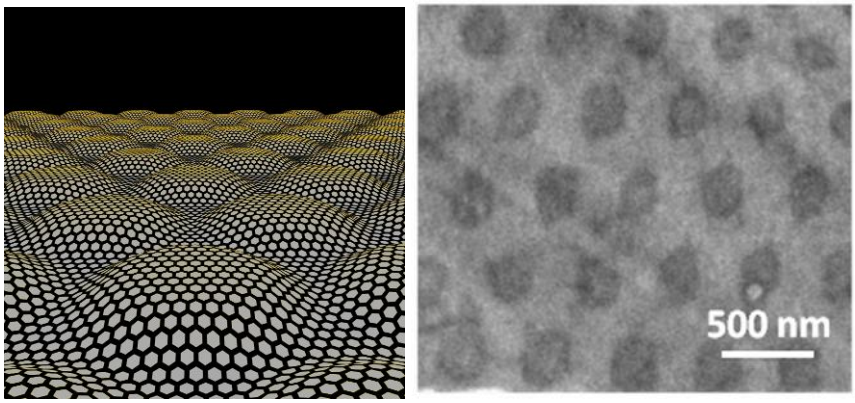

Fig.1 (left) the scheme of periodic strained graphene on a patterned substrate. (right) the SEM image of periodic modified graphene.