Assessment of Graphene Elastic Modulus Using Push-to-Pull Device in Scanning Electron Microscope

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Besides other graphene's extraordinary physical properties, 2D structure of graphene also p possess outstanding mechanical properties with a theoretical elastic modulus estimated to 1TPa. Push-to-pull device enabled scientists to observe and assess elastic and fracture properties of a free-standing graphene monolayer [1], crack propagation of pre-cracked graphene in SEM [2], or in-situ stretching of graphene nanoribbons in TEM [3].
We focused on the experimental aspects of usage of push-to-pull device (Figure 1) with PI85 SEM PicoIndenter. Specifically, we provide an insight into none-uniform strain field over the width of graphene samples during push-to-pull tensile testing. Effect of strain heterogeneity as well as of locally different adhesion levels of graphene to silicon oxide substrate of push-to-pull device will be presented on stiffness measurements by gradual straining of free-standing graphene.

References

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[3] Zhongquan Liao, Leonardo Medrano Sandonas, Tao Zhang, Martin Gall, Arezoo Dianat, Rafael Gutierrez, Uwe Mühle, Jürgen Gluch, Rainer Jordan, Gianaurelio Cuniberti & Ehrenfried Zschech, Scientific Reports, 7 (2017) 211

Figures

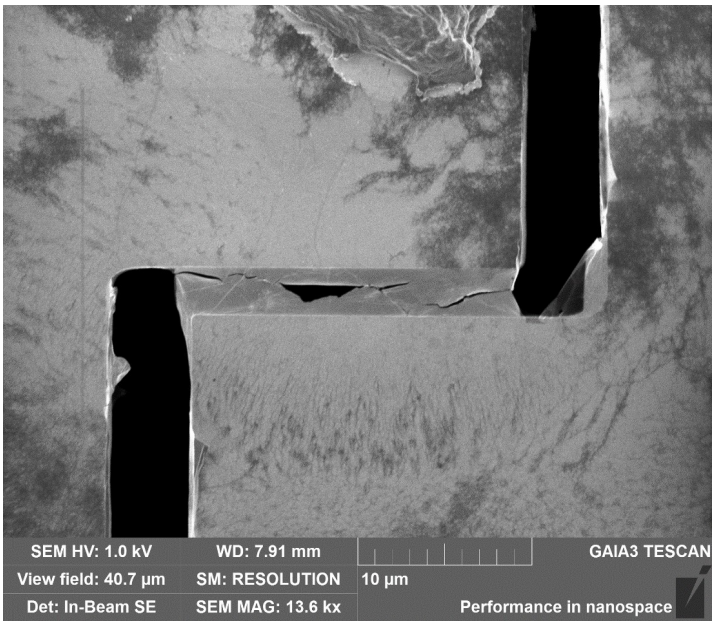

Figure 1: SEM image of ruptured graphene sheet still attached over the slit of Push-to-Pull device.