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Challenges and Insights by Electrical Characterization of Large Area Graphene Layers

The current advances in the research and manufacturing of large area graphene layers are promising towards the introduction of this exciting material in display industry and other applications that benefit from excellent electrical and optical characteristics (cf. figure 1). New production technologies in the fabrication of flexible displays, touch screens or printed electronics apply graphene layers on non-metal substrates and bring new challenges to the required metrology. Traditional measurement concepts of layer thickness, sheet resistance and layer uniformity are difficult to apply to graphene production processes and are often harmful to the product layer. New non-contact sensor concepts are required to adapt to the challenges and even the foreseeable inline production of large area graphene. [1]
Dedicated non-contact measurement sensors are a pioneering method to leverage these issues in a large variety of applications, while significantly lowering the costs of development and process setup. Transferred and printed graphene layers can be characterized with high accuracy in a huge measurement range [2] using a very high resolution (cf. figure 2 and 3). Large area graphene mappings are applied for process optimization and for efficient quality control for transfer, doping, annealing and stacking processes. Examples of doped, defected and excellent Graphene are presented as quality images (cf. figure 4) and implications for manufacturers are explained [3] [4].

References

[1] Bae, S. et al., Nature Nanotechnol, 5 (2010) 574–578
[2] M. Klein, R. Kupke, M. Griessbach, Proceedings Graphene, Genua, Electrical Characterization of Large Area Graphene Layers, 2016
[3] J. Lama, I. Gil, A. González et al. Proceedings Nanotech Dubai, (2015)
[4] M. Klein, R. Kupke, M. Busch Proceedings Graphene Workshop Dresden, (2016)

Figures

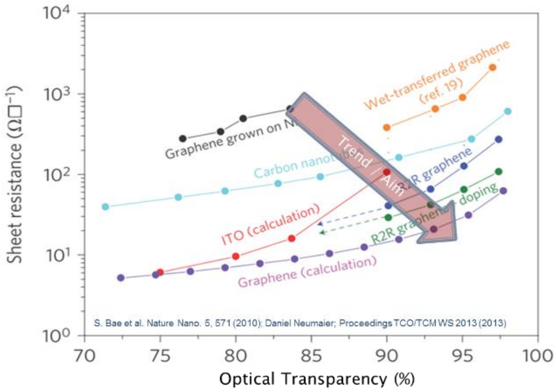

Figure 1:. Achievable sheet resistance to optical transparency performance of Graphene and ITO

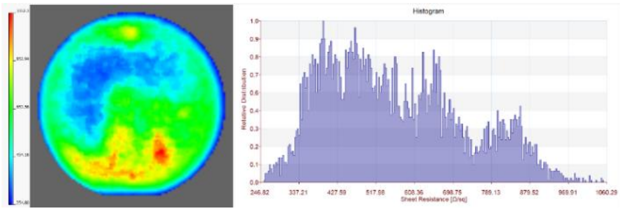

Figure 2: 4 inch Graphene showing handling defects

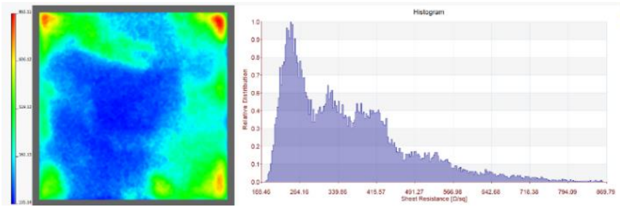

Figure 3:. 6 x 6 inch Graphene transferred on PET with transfer defects

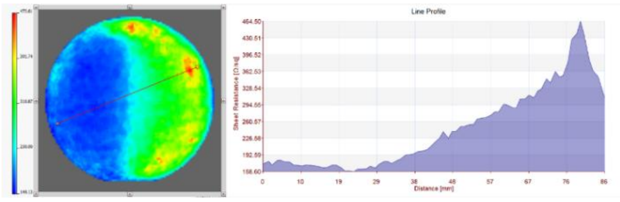

Figure 4: Fig. 4. 4 inch Graphene with strong doping profile