chem2Dmat
September 03-06, 2019 ● Dresden, Germany
European Conference on Chemistry of Two-Dimensional Materials

Functionalization of Graphene Field-Effect Transistors with Perylenes

Laura Höltgen[*], Kangho Lee[*], John McManus[#], Chanyoung Yim[*], Rita Siris[*], Corinna Weiss[+], Frank Hauke[+], Andreas Hirsch[+], Georg S. Duesberg[*,#]

[*]Universität der Bundeswehr München, Werner-Heisenberg-Weg 39, 85577 Neubiberg, Germany
[#] School of Chemistry, Trinity College Dublin, College Green, Dublin 2, Ireland
[+] Institut für Organische Chemie, Henkestr. 42, 91054 Erlangen, Germany
Laura.Hoeltgen@unibw.de

Following the discovery of graphene's unique properties, the integration of the 2D material into various electrical devices such as sensors is of prime interest. Generally, for large scale integration graphene grown by chemical vapor deposition (CVD) is placed onto an insulating substrate using the polymer-assisted transfer technique. For most electrical applications, it is desired to keep the intrinsic properties of graphene unchanged which may be accomplished by passivation layers, while for sensing applications a functionalization is necessary to achieve selectivity. For both non-covalent functionalizations perylene may be employed. In this presentation transferred CVD grown graphene before and after liquid phase functionalization with perylene is analyzed using Raman spectroscopy, scanning electron microscopy (SEM) and electrical measurements. In addition, the effects of functionalization are electrically investigated by realizing graphene field-effect transistor (GFET) arrays. These measurements indicate that the pristine graphene is p-doped and there is an n-doping contribution due to the functionalization. Furthermore, a significant mobility increase of 20 – 35 % after functionalization of the GFET is observed. These results imply a promising step towards passivation and functionalization of sensing applications.

References

[1] Ferrari, A. C., et al. Phys. Rev. let. 97.18 (2006) 2-4
[2] Anichini, C., et al. Chemical Society Reviews, 47 (2018), 4860-4908
[3] Sedra, A.S.,et al., Oxford Univ. Press, 5. edt. (2004)
[4] Sarma, S., et al., Rev. Mod. Phys. (2011), 407–470
[5] Hallam, T., et al., Phys. Status Solidi B (2013)
[6] Georgakilas, V., et al., Chemical Reviews (2012), 6156–6214

Figures

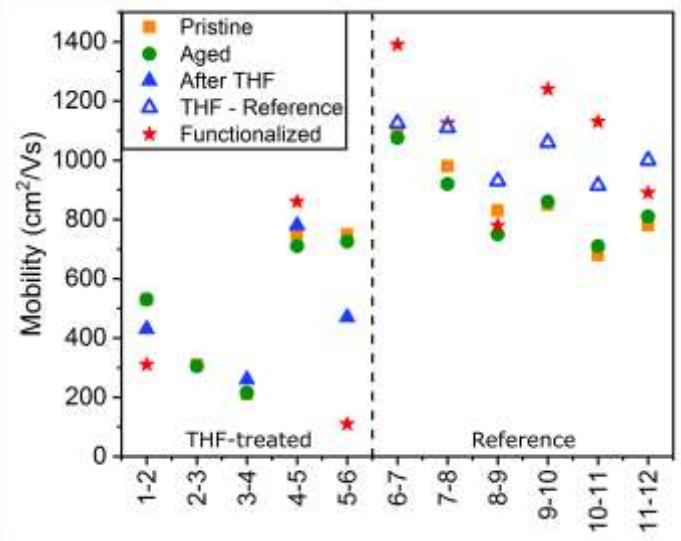

Figure 1: Charge carrier mobilities for 11 devices of a GFET array, after various treatment steps.