

Covalent modification of large area monolayer graphene towards biosensing.

Felix Rösicke^{1,2}, Marc Gluba¹, Guoguang Sun³, Karsten Hinrichs³, Norbert Nickel¹, and Jörg Rappich¹

¹Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Institut für Si-Photovoltaik, Kekuléstr. 5, 12489 Berlin, Germany

²School of Analytical Sciences Adlerhof (SALSA), Humboldt University of Berlin, Sitz: IRIS-Building, Adlershof, Unter den Linden 6, 10099 Berlin, Germany

³Leibniz-Institut für Analytische Wissenschaften - ISAS - e.V., Department Berlin, Schwarzschildstr. 8, 12489 Berlin, Germany

Felix.Roesicke@helmholtz-berlin.de

Abstract

We investigated the electrochemical grafting of para-N-maleimidophenyl (p-MP) onto graphene from the respective diazonium salt (*p*-(N-Maleimido) benzenediazonium tetrafluoroborate, p-MBDT) by electrochemical quartz crystal microbalance (EQCM), Raman- and infrared spectroscopies. The p-MP residue is well known to react with any SH-group present in solution and is therefore a possible candidate to build up bio-sensing devices. In combination with graphene, this forms a very stable and conductive system that can be transferred to any substrate. The sample preparation was performed by transfer of CVD grown large area graphene [1] to an isolating layer of SiN_x on Au-coated QCM chips. Using graphene as working electrode, the current transfer behaviour and the change in the resonance frequency of the QCM chip reflect the electrochemical reduction of the diazonium compound and binding to the graphene layer surface that was additionally supported by Raman and infrared spectroscopies. The charge used for the reduction of p-MPDT correlates well to the amount of grafted p-MP and the observed defect density of graphene. The calculated faradaic efficiencies resemble the deposition of p-MP on bare Au-QCM chips [2]. Finally the p-MP functionalized graphene surface was tested by reaction with 4-nitrobenzenethiol. This was the first time EQCM experiment using graphene as working electrode

References

1. M. A. Gluba, D. Amkreutz, G. V. Troppenz, J. Rappich, and N. H. Nickel, Appl. Phys. Lett. **103**, 073102 (2013).
2. X. Zhang, F. Rösicke, V. Syritski, G. Sun, J. Reut, K. Hinrichs, S. Janietz, and J. Rappich, Z. Phys. Chem. **228**, 557 (2014).