Graphene derivatives for electrochemical sensing

Michal Otyepka

Regional Centre of Advanced Technologies and Materials, Czech Advanced Technology and Research Institute (CATRIN), Palacký University Olomouc, Šlechtitelů 27, 783 71 Olomouc, Czech Republic
VSB – Technical University of Ostrava, 17. listopadu 2172/15, 708 00 Ostrava-Poruba, Czech Republic
Michal.Otyepka@upol.cz

Graphene equipped with specific chemical groups would be a wonder material for sensing applications. Synthesis of such graphene derivatives directly from graphene is, however, hampered by its low reactivity. Graphene oxide and its reduced forms are chemically complex materials. Chemistry of fluorographene represents a promising strategy for obtaining controllable and well-defined graphene derivatives. [1] Our lab introduced a wide portfolio of graphene derivatives via this approach and demonstrated their potential in wide range of applications including sensing,[2-5] catalysis [6-8] and energy storage. [9-11] A two-step synthesis leads to graphene acid, i.e., graphene bearing ~10-15% of covalently grafted carboxyl groups on both sides [12]. Graphene acid is perfectly water dispersible, biocompatible, and conductive (~25 S/m) material. These features predispose it as an electrode material for electrochemical sensing applications. Graphene acid can be further conjugated with other molecules,[12] enzymes [13] and nucleic acids [4,5] via carbodiime or click chemistry.[5] Using click chemistry, a selective aptamer can be immobilized and used as a successful platform for the selective determination of ampicillin in real samples in the presence of interfering molecules. The constructed electrochemical aptasensor displays a detection limit of 1.36 nM, high selectivity among other antibiotics, storage stability of 4 weeks and is effective in real samples. This strategy enables fast and simple construction of various (bio)sensors.

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