Studies of Graphene as Electrode Material for Sensor Applications

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Biosensors are one of the field which are envisioned to be improved by the use of two-dimensional carbon nanomaterials. There are many strategies to produce graphene, divided in two principles of a bottom-up synthesis or a top-down approach. The resulting materials differ a lot in their chemical and physical properties. Therefore, the main interest of this work was to compare and characterize graphene prepared by different methods in terms of their applicability in electrochemical sensor development.

A low number of defects in the graphene lattice is mandatory for high electron transfer rates and therefore sensitive detection of analytes like glucose, ascorbic acid, or dopamine. Chemically derived graphene, which is characterized by a lot of defects in the sp^2 carbon lattice was optimized by thermal treatment and by electrochemical reduction. Parameters like the increase of the surface after deposition of a graphene material on top of a micro electrode, as well as the stability was studied in detail. The electrochemical properties of graphene oxide and reduced graphene oxide prepared by different reduction processes were investigated. Chemically reduced graphene deposited on a silicon wafer followed by a short thermal annealing step turned out to be the most promising graphene material for the development of electrochemical sensors.