Composites materials of graphene derivatives and electrically conducting polymers and their application in solid-state ion-selective electrodes

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Abstract

We report the electrochemical and chemical synthesis of different types of composite materials consisting of either graphene oxide (GO), reduced GO or exfoliated graphite and conducting polymers, such as poly(3,4-ethylenedioxythiophene) [1,2], polypyrrole [1], poly(N-methylaniline) [3] and polyaniline [4,5].

The presentation focuses on their synthesis, electrochemical reduction of graphene oxide in the electrically conducting polymer matrix, the improved electron transfer and capacitive properties, and long-term potential cycling stability. It is shown that the electrochemical reduction improved the electron transfer in the composite materials [4,5]. Especially for composites with polyaniline, the electroreduction improved the charging/discharging properties of the composite film with 30% and its redox capacitance (pseudocapacitance) with 15% [5].

Moreover, some of the composites were applied as ion-to-electron transducers in potentiometric solid-state ion-selective electrodes (ISEs). It has been shown that a low water uptake of the membrane materials (high hydrophobicity) is a crucial factor for obtaining solid-state ISEs with stable response characteristics, reproducible standard potential and good long-term stability [5]. We have studied with potentiometry and FTIR spectroscopy how the hydrophobicity of the transducer layer influences the potential stability of the solid-state ISEs during the initial contacting of the electrodes with aqueous electrolyte solutions for 24 h. The final goal of our studies is the fabrication of printable capacitors and conditioning- and calibration-free solid-state ISEs.

References

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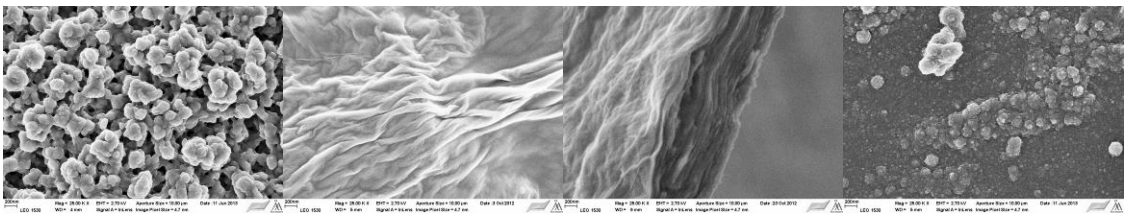

PEDOT-rGO (1) PEDOT-rGO (2) PEDOT-rGO (2) PANI-Cl-GO