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Conducting Polymer/Exfoliated Graphite Composites for Electrochemical Detection of Neurotransmitters

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Electrochemical detection of neurotransmitters is essential for the diagnosis and monitoring of neurological disorders, requiring sensitive, rapid, and cost-effective analytical platforms. Carbon-based materials, particularly exfoliated graphite (EG), have attracted considerable attention due to their high surface area, good electrical conductivity, and chemical stability [1].

In this study, conducting polymer/exfoliated graphite composites were developed and investigated as electrode materials for neurotransmitter detection. EG was synthesized from graphite precursors of different particle sizes via intercalation followed by thermal exfoliation. The obtained material was further modified using conducting polymers, including polypyrrole (PPy) and polythiocyanogen ($(SCN)_n$), employing wet-chemical and mechanochemical synthesis routes.

Structural characterization using Raman spectroscopy, FTIR, and XPS confirmed the successful incorporation of heteroatoms (N, S) into the graphitic structure, leading to increased defect density and enhanced electroactive surface properties. The results revealed that both the graphite precursor grain size and the type of conducting polymer significantly influence the structural and electrochemical characteristics of the composites. Electrochemical studies demonstrated that the composite derived from medium-sized graphite exhibited the most balanced performance. PPy/EG-based sensors showed high sensitivity (up to 2180 µA mM^{-1} cm^{-2}) and a low detection limit (78 nM) for dopamine, while $EG(SCN)_n$/EG composites enabled sensitive serotonin detection with a detection limit as low as 59.5 nM and sensitivity of 1893 µA mM^{-1} cm^{-2} [1, 2]. These findings demonstrate that conducting polymer/EG composites are promising metal-free materials for electrochemical detection of biologically relevant analytes, offering potential for application in biomedical sensing technologies.

References

[1] G. Rimkute, et. al, “Synthesis of a novel exfoliated graphite/polythiocyanogen composite for electrochemical serotonin detection”, Applied Surface Science, 713, 164379, 2025.
[2] G. Rimkute, et. al, “Synthesis and characterization of exfoliated graphite-polypyrrole composites as active electrode materials for the detection of dopamine”, Applied Surface Science, 686, 162107, 2025.