

# Application of Multi-Walled Carbon Nanotubes in Electrochemistry

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The topic of the lecture is the synthesis of novel nanocomposite materials consisting of various types of multi-walled carbon nanotubes (further denoted as MWCNTs), their modification with metal nanoparticles, and their application for electrochemical analysis of redox systems with great biological interest.

Consequently, the catalytic chemical vapor deposition technique (CVD) applied for synthesis of undoped carbon nanotubes (MWCNTs) [1], as well as carbon nanotubes that have been doped with nitrogen (N-MWCNTs) [2], phosphorus (P-MWCNTs) [3], boron (B-MWCNTs) [4], and sulfur (S-MWCNTs) [5, 6], will be presented and discussed.

Furthermore, the analytical methods applied for the study and characterization of the various types of synthesized carbon nanotubes, such as scanning electron microscopy (SEM), transmission electron microscopy (TEM), Raman spectroscopy, cyclic voltammetry (CV), differential pulse voltammetry, and electrochemical impedance spectroscopy (EIS), will be thoroughly considered and discussed.

The modification of synthesized undoped MWCNTs and heteroatom-doped-MWCNTs with metal nanoparticles, such as rhodium, palladium, iridium, platinum, silver and gold [7], and their influence in electrochemical properties of carbon nanotubes, and thus, in sensitivity and detection capability of fabricated biosensors will be also discussed in detail.

Finally, the application of synthesized nanocomposite materials for the simultaneous electrochemical detection and analysis of molecules with biological interest, such as dopamine, ascorbic acid, uric acid, and glucose will be also examined.

The enhanced sensitivity, and consequently, the improved detection capability (lower limits of detection in micromolar region) that have been observed for carbon nanotubes doped with nitrogen and modified with gold nanoparticles (N-MWCNTs/AuNPs), will be systematically discussed and compared with available data published in literature for other novel nanostructured materials.

The main aim of the lecture is to demonstrate the importance of using/incorporating carbon nanotubes in electrochemical biosensors for amplifying their sensitivity as well as their detection capability.

## **References**

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