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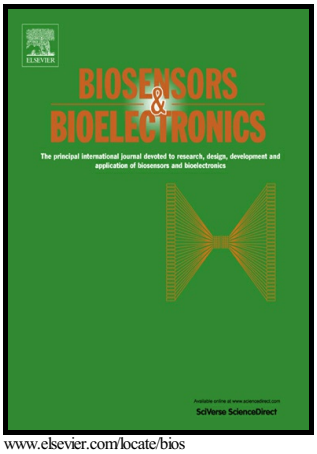

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RGO/Au NPs/N-doped CNTs supported on Nickel Foam as an Anode for Enzymatic Biofuel Cells

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Abstract

In this study, three-dimensional reduced graphene oxide/Au NPs/nitrogen-doped carbon nanotubes (RGO/Au NPs/N-doped CNTs) assembly supported on nickel foam was utilized as an anode for enzymatic biofuel cells (EBFCs). 3D RGO/Au NPs was obtained by electrodepositing reduced graphene oxide on nickel foam (Ni foam), while Au NPs were co-deposited during the process. Afterwards, nitrogen doped CNTs (N-CNTs) were allowed to grow seamlessly on the surfaces of 3D RGO/Au NPs via a simple chemical vapor deposition (CVD) process. In this nanostructure, Au NPs co-deposition and nitrogen doping offer more active sites for bioelectrocatalysis. Additionally, N-CNTs were demonstrated providing high specific surface area for enzyme immobilization and facilitating the electron transfer between glucose oxidase (GOx) and electrode. The resulting bioanode achieved efficient glucose oxidation with high current densities of 7.02 mA cm^{-2} (0.3V vs.Ag/AgCl). Coupling with a Pt cathode, the fabricated glucose/air biofuel cell exhibited an open-circuit potential of 0.32 V and generated a maximum power density 235 μW cm^{-2} at 0.15V. This novel electrode substrate achieved high performance in current density at bioelectrochemical systems and could be useful for further exploiting the application of three dimensional carbon-based nanomaterials in EBFCs.

Graphical abstract