

**Title :** Electrocatalytic Alcohol Oxidation on Pt/Caffeine/GO and Pt/Caffeine/CNTs: Carbon-Molecule Synergy for Fuel Cell Applications

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## ABSTRACT

Two carbon-based electrocatalytic systems, Pt/caffeine/GO and Pt/caffeine/CNTs, were developed for efficient alcohol ethylene glycol oxidation by combining graphene oxide (GO) or carbon nanotubes (CNTs) with caffeine, followed by Pt-electrochemical deposition. The surface modification with caffeine enhanced the interaction between the carbon supports and Pt, leading to improved dispersion and catalytic activity. Cyclic voltammograms (CVs) demonstrated that the Pt/caffeine/GO and the Pt/caffeine/CNTs catalysts exhibited higher current density, lower onset potential, and reduced potential at maximum current intensity, compared with their non-modified counterparts, with the Pt/caffeine/CNTs showing the highest activity. Chronoamperograms (CAs) confirmed the long-term durability of the catalysts, maintaining high current intensity even after 3600 s of continuous operation. These results indicate that both Pt/caffeine/GO and Pt/caffeine/CNTs are promising electrocatalysts for direct alcohol fuel cell applications, with caffeine serving as an effective molecular modifier to enhance catalytic efficiency and stability.

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