הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע״ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Seminar

Monday, May 5th, 2025 at 13:30

Room 5

Graphite fiber felt cathode for selective H_2O_2 electro-production: from modification to scale up

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Mid PhD Seminar

Advisor: Prof. Raphael Semiat
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Abstract

Hydrogen peroxide (H_2O_2) is a versatile chemical widely used in water treatment, chemical synthesis, and environmental remediation. Electrochemical synthesis via the two-electron oxygen reduction reaction ($2e^-$-ORR) offers a sustainable, on-site alternative to conventional production methods. The objective of this study was to investigate room-temperature acidic treatments with H_2SO_4, HCl, and HNO_3 as a modification strategy for graphite fiber felt (GF), aiming to enhance its electrochemical performance and selectivity for efficient H_2O_2 production. The effects of these treatments were systematically characterized through SEM, Raman spectroscopy, FTIR, conductivity measurements, and contact angle analysis, revealing significant structural and surface modifications, including the introduction of functional groups, and increased hydrophilicity.

Among the treatments, 4M H_2SO_4 proved the most effective, increasing the equilibrium H_2O_2 concentration to 163.9 mg/L, significantly outperforming untreated GF, which yielded only 8.5 mg/L. Electrochemical performance was evaluated using cyclic voltammetry and rotating ring-disc electrode techniques, confirming improved activity and selectivity of H_2O_2 electro-production. Pearson correlation and heat map analysis demonstrated a strong relationship between GF modifications—such as defect density, oxygen functionalization, and hydrophilicity—and electrochemical H_2O_2 production efficiency. These findings highlight room-temperature acidic oxidation as a simple yet effective strategy for enhancing GF cathodes, improving their activity and selectivity for H_2O_2 generation.

Refreshments will be served at 13:15.