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Project Title: **Design and Development of a Rotating Electrode Membraneless Electrolyzer (REME) using Electrodeposited Cobalt–Nickel Catalysts for Scalable Green Hydrogen Production.**

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Abstract: **Design and Development of a Rotating Electrode Membraneless Electrolyzer (REME) using Electrodeposited Cobalt–Nickel Catalysts for Scalable Green Hydrogen Production.**

This project addresses the urgent need for sustainable energy solutions by focusing on green hydrogen production as a clean, zero-carbon fuel. Conventional water electrolysis technologies such as alkaline and polymer electrolyte membrane (PEM) systems, are limited by high costs, reliance on expensive membranes and noble metal catalysts, and complex system architectures. These challenges hinder large-scale adoption despite the growing global interest in hydrogen as a key energy carrier.

To overcome these limitations, the proposal explores a membraneless electrolyzer (ME) approach, which eliminates costly membranes and enables the use of abundant, non-precious materials. However, existing MEs suffer from issues such as gas crossover and bubble accumulation, which reduce efficiency and increase energy losses.

The project introduces an innovative Rotating Electrode Membraneless Electrolyzer (REME) to address these challenges. The system employs rotating mesh electrodes that generate centrifugal force to effectively remove gas bubbles from electrode surfaces, thereby enhancing mass transfer, increasing active surface area, and reducing overpotential. A cylindrical separator is incorporated to further minimize gas crossover between electrodes.

The REME design utilizes cost-effective materials, including cobalt-deposited nickel mesh as the anode and nickel-modified stainless steel as the cathode, ensuring both performance and affordability. Powered by solar energy, the system aligns with sustainability goals.

By developing a scalable, low-cost, and efficient membraneless electrolyzer, this project aims to fill a critical research gap and contribute to the advancement of green hydrogen technologies and the global transition toward a decarbonized energy future.