Novel Catalysts toward Carbon Neutral Recycling

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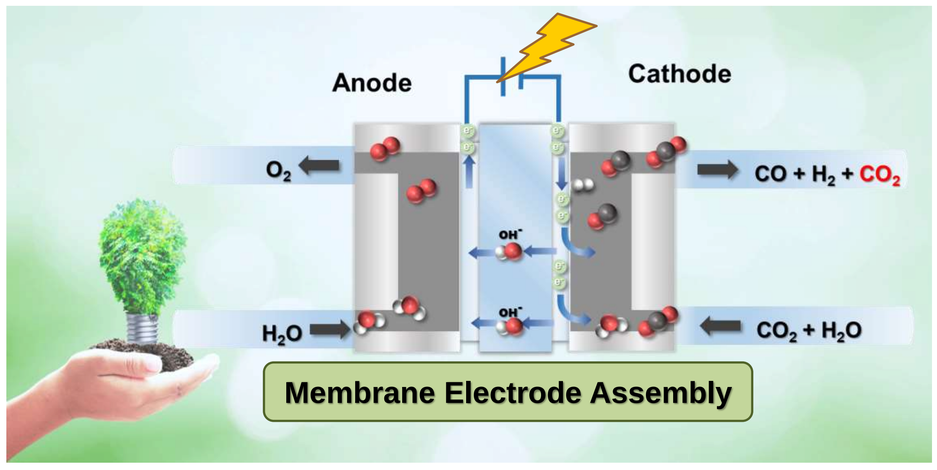
Abstract

In this project, we propose to develop an electricity-driven CO_2 electrolysis system to reach the goal of carbon neutral recycling (CNR). With fabricated CO_2RR and OER catalysts, we are able to efficiently produce syngas, which not only effectively deplete CO_2, the targeted green-house gas, but also break down the obstacles of high cost in electrolysis process by utmostly lowering overpotential.

Our proposed high-efficiency catalysts intrinsically reduce the overpotentials of CO_2RR half-reaction in which state-of-the-art single-atom Fe^{3+}-N-C catalysts take lead. For the industrial applications, scale-up and stability issues turn out to be the first paramount subjects in realization of long-term necessities. Additionally, we would like to introduce nitride dopants to improve stability of the promising OER catalytic materials as well as to advance the redox-capability of current metal oxide system in which substantial morphology reconstruction and reduced lifetime of catalytic hinder current large-scale applications. From theoretical prediction to development of high-efficiency novel catalysts, our team continue to enlarge catalyst productions as well as to engineer reaction scales toward the target milestone.



Objectives and Progress

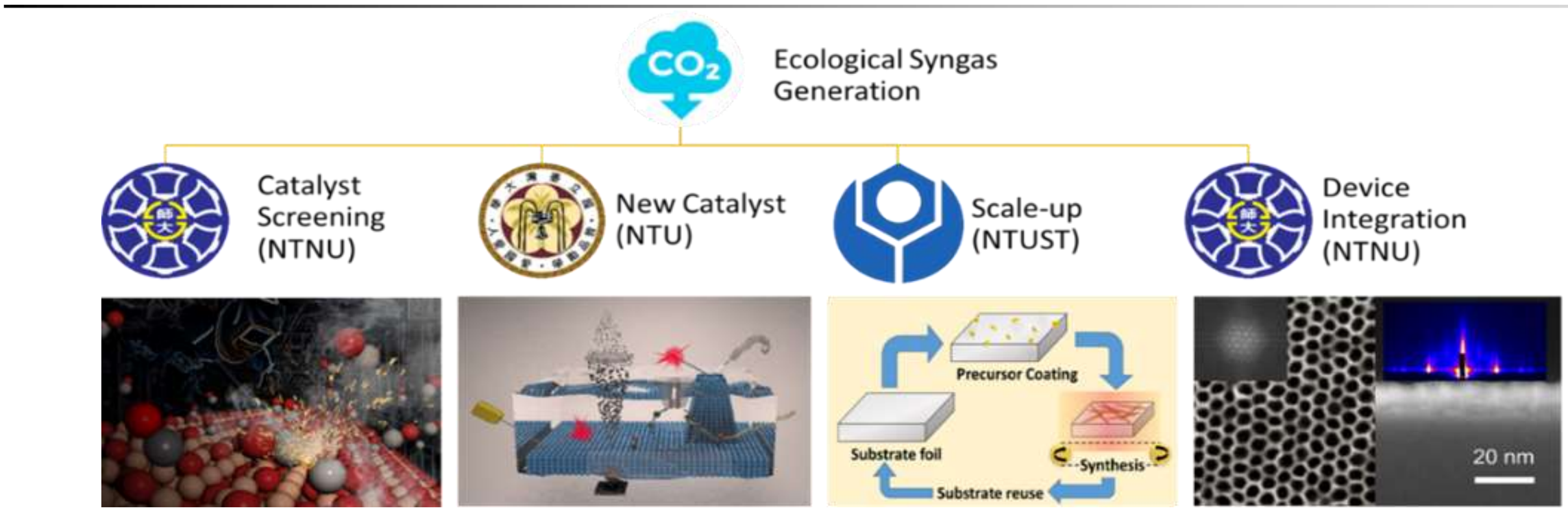


Figure 1. Scheme of cooperative research from four subtasks toward ecological syngas generation project.

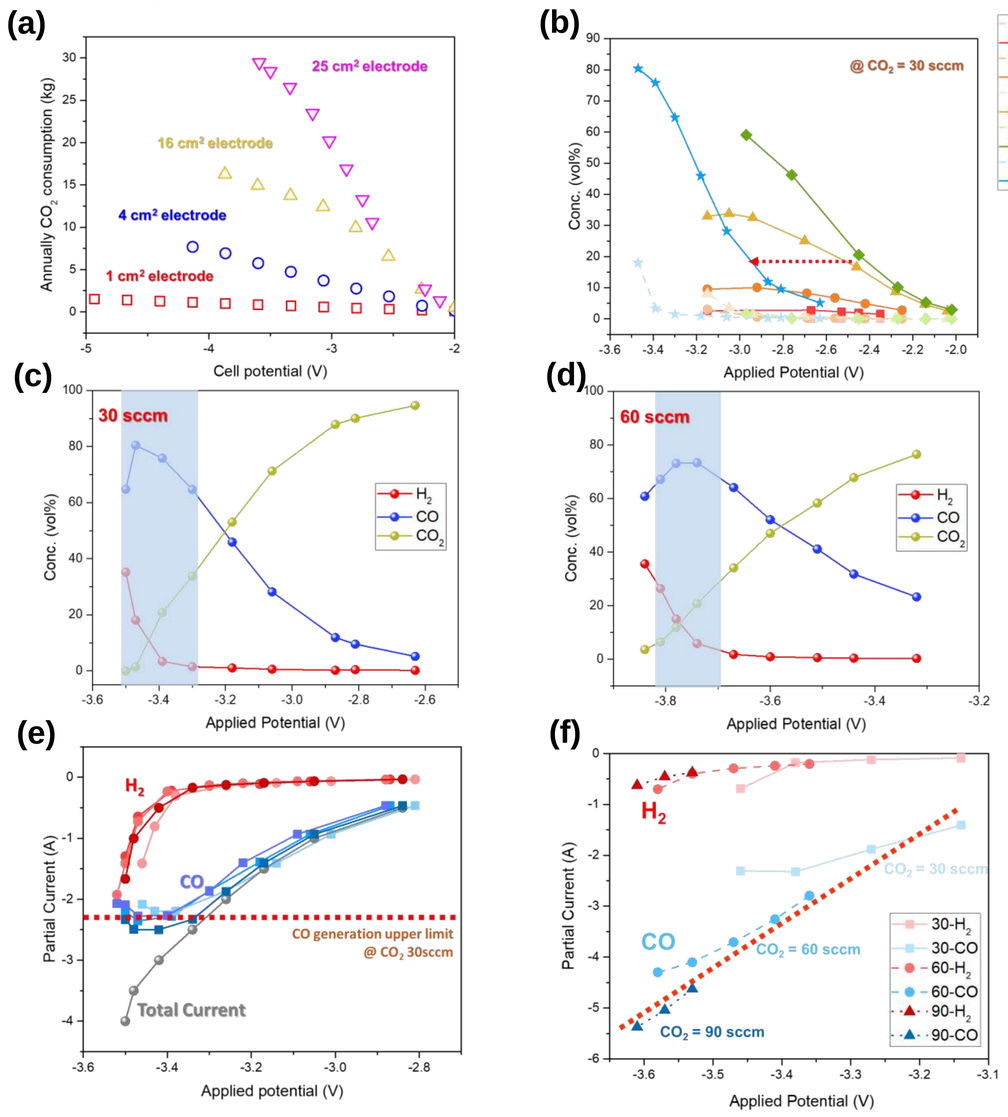


Figure 2. Product gas analysis and CO generation performance with scaling areas. (a) CO_2 depletion plot (b) product gas analysis with scaling reaction area, and with CO_2 feeding at (c) 30 (d) 60 sccm. CO generation performance (e) with CO_2 feeding at 30 sccm (f) with increasing feeding.

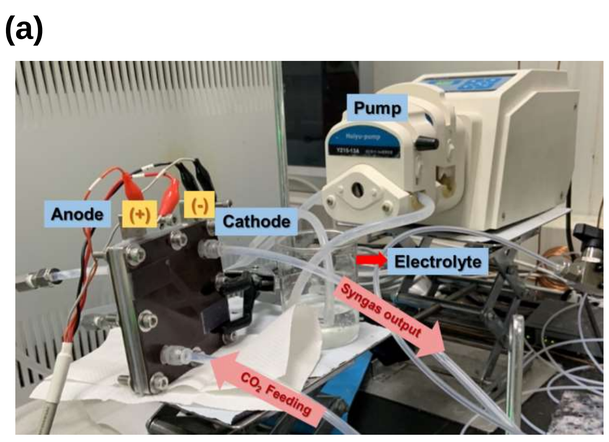


Figure 3. Setup of (a) single and (b) multiple-cell CO generation system.

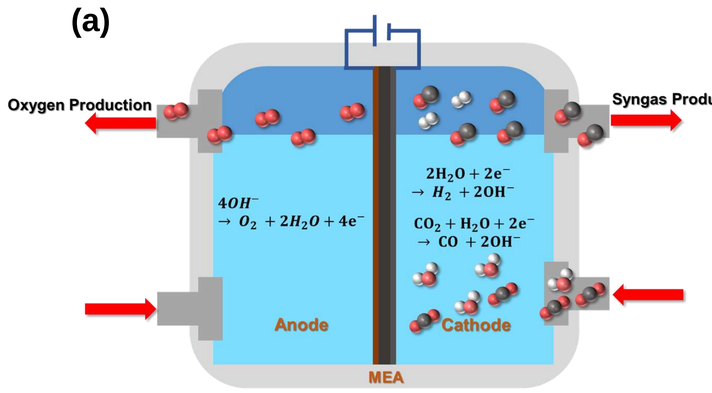


Figure 4. Aqueous type CO generation system.
(a) Scheme of aqueous type CO generation system.(b) Modified flow cell (c) Setup of aqueous type CO generation system

Acknowledgement

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