Electrolysis of Carbon Dioxide in the Production of Sustainable Fuels

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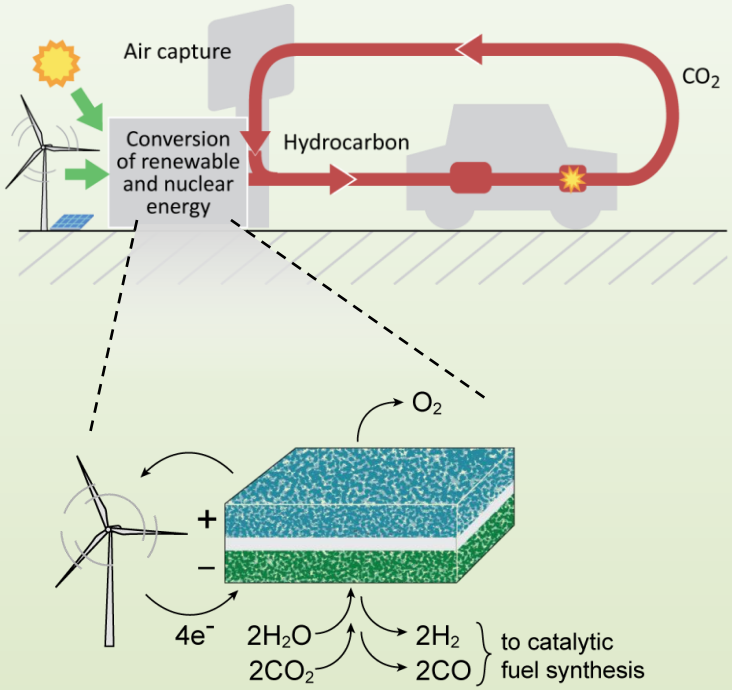
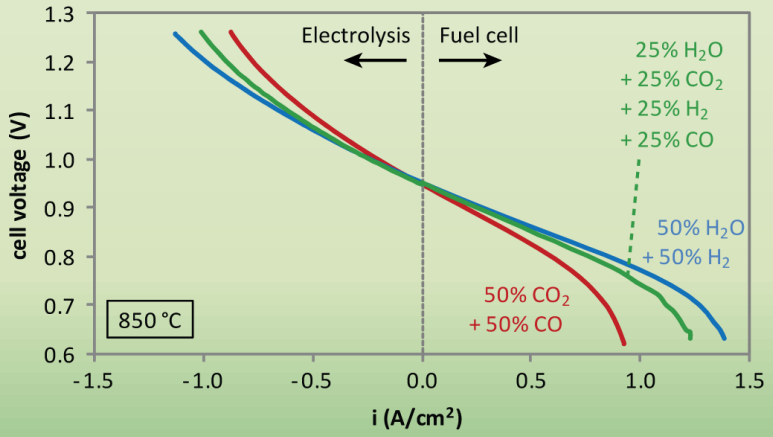
We are developing a sustainable hydrocarbon fuel cycle using renewable and/or nuclear energy (without fossil fuel or biomass resources).

CO_2 is recycled back into fuels via high temperature electrolysis of CO_2 and H_2O. Capturing CO_2 from the atmosphere will enable a closed-loop fuel cycle analogous to the electrolytic hydrogen economy with the advantage that the fuel can be used in existing infrastructure.

Our experimental results have demonstrated the feasibility of CO_2 electrolysis and co-electrolysis of CO_2 and H_2O. We studied the performance and durability of state-of-the-art solid oxide cells designed as fuel cells, by systematic DC and AC electrochemical characterizations. Based on our assessment of the energy balance and economics, we have shown that with a high cost of oil and inexpensive non-fossil energy sources, it will be possible to produce CO_2-based synthetic fuels at a lower cost than equally clean fossil fuels.

To make this process affordable on a larger scale—competing against a lower oil cost and using a wider variety of energy sources—we have set out to improve the durability of the negative-electrode by developing new electrode materials.





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