Electrolysis of Carbon Dioxide in the Production of Sustainable Fuels

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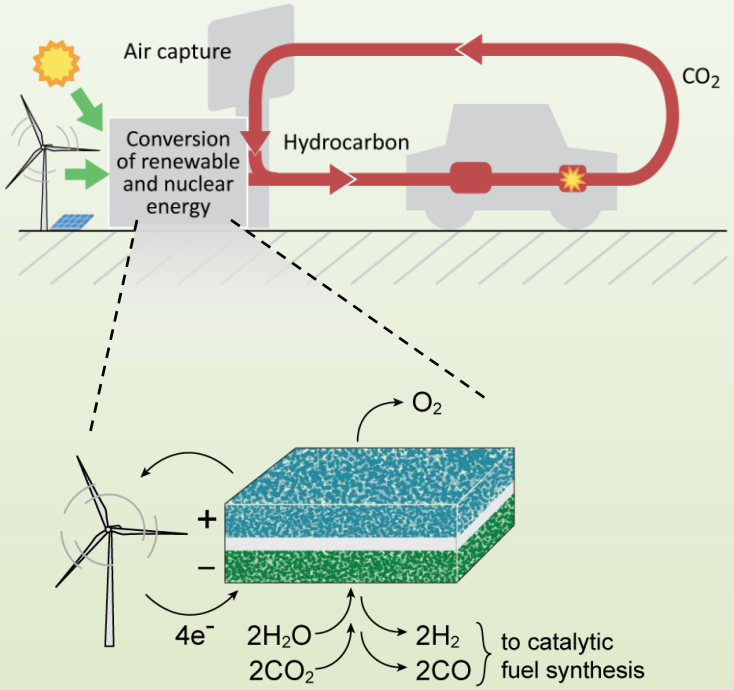
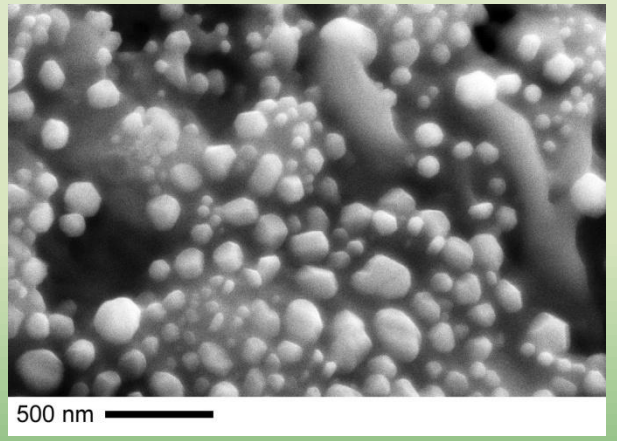


We are developing a sustainable hydrocarbon fuel cycle using renewable and/or nuclear energy (without fossil fuel or biomass resources).

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.

Previously we tested the performance and durability of state-of-the-art solid oxide fuel cells applied for CO_2 electrolysis and co-electrolysis of CO_2 and H_2O. Our assessment of the energy balance and economics showed that 70% electricity-to-liquid fuel conversion efficiency is feasible and that competitive synthetic gasoline could be produced with electricity priced at 2-5 cents per kWh, depending on the durability of the cells, the intermittency of operation (e.g. if running on solar or wind power), and the price of oil to compete with.

Recently we have developed new electrode materials that form nanostructured surfaces during operation which exhibit high electrocatalytic activity for H_2O and CO_2 electrolysis. These could replace the conventional fuel electrode composed of nickel and stabilized zirconia and improve the cell performance and durability.



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