Photoelectrochemical CO_2 Reduction towards Multicarbon Products with Silicon Nanowire Photocathodes Interfaced with Copper Nanoparticles

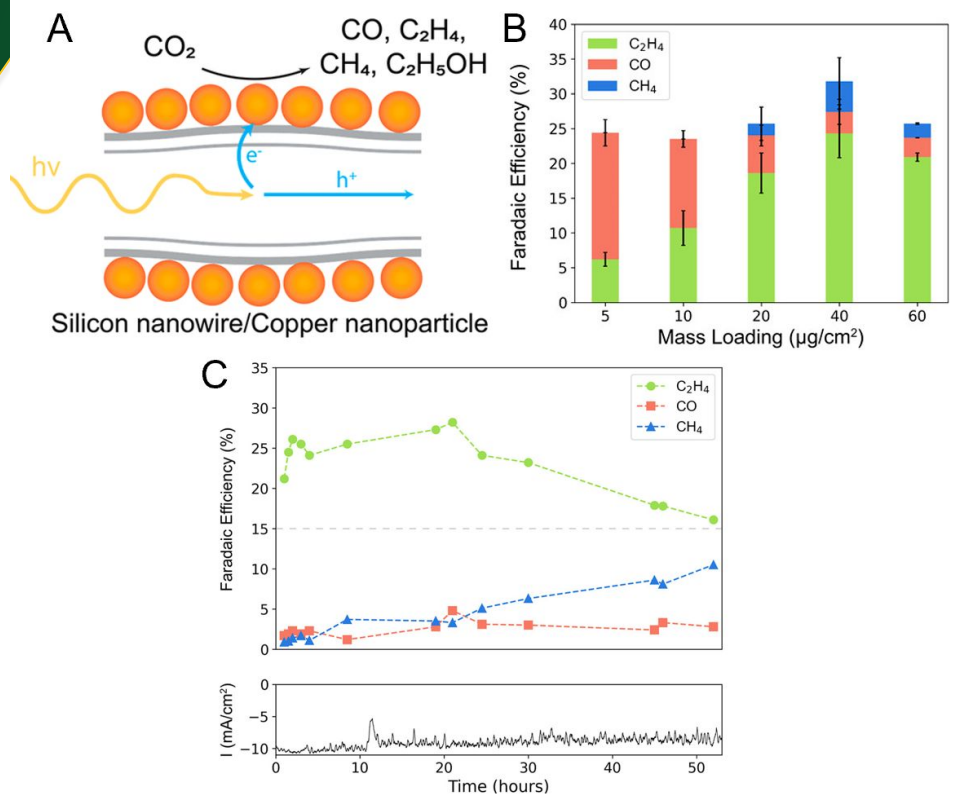

Fig. (A) Schematic illustrating the integrated CuNP/SiNW photocathode and charge separation. (B) Faradaic efficiencies toward CO_2 reaction gas products as a function of mass. (C) Stability demonstration for 50 hours under applied bias (-0.5 V vs RHE) and 1 sun illumination.

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Scientific Achievement:

This study demonstrates the selective photoelectrochemical conversion of CO_2 to multicarbons at low applied biases by taking advantage of highly active copper nanoparticles to effectively utilize photogenerated charges.

Significance and Impact:

Our findings suggest new opportunities for photocathode design where light absorbers are interfaced with nanoparticles designed for selective catalytic reactions, improving the overall efficiency of the system.

Research Details:

- The large surface area of the nanowires allows for a large mass loading of nanoparticle catalyst which plays an important role in selectivity and activity for CO_2 conversion, at low overpotential.
- Through effective charge separation and utilization, holes are driven away from the surface, showing photocurrent and catalytic stability for CO_2-to-C_2H_4 conversion.

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