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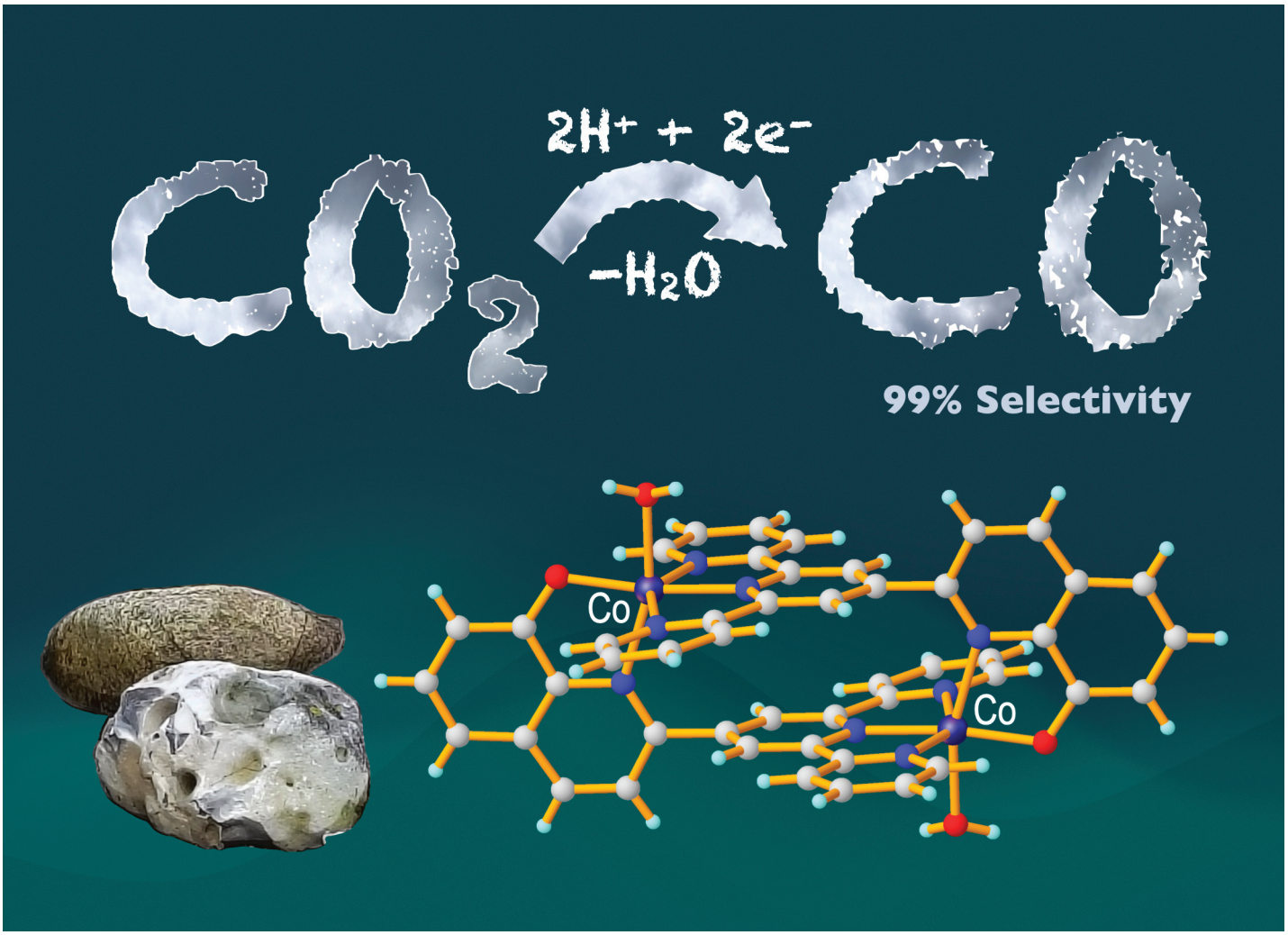

Showcasing research from Professor Sumanta Kumar Padhi's Artificial Photosynthesis laboratory, Department of Chemistry and Chemical Biology, Indian Institute of Technology (Indian School of Mines) Dhanbad, Jharkhand, INDIA.

Selective electrochemical CO_2 reduction to CO by a Co(II) dimer catalyst by metal–ligand cooperativity

Electrochemical CO_2 reduction offers a promising route to mitigate greenhouse gas emissions. We report a cobalt dimer catalyst that selectively converts CO_2 to CO in DMF/H_2O (4.8 : 0.2 v/v) with 94 ± 2% Faradaic efficiency, 99% selectivity, and TOF_{max} = 2575 s^{-1} at a 760 mV overpotential. Mechanistic studies (DFT, IR-SEC, KIE) reveal ECEC and EECC pathways involving stepwise proton–electron transfer and metal–ligand cooperativity. Reduction-induced ligand protonation enables CO_2 activation, providing mechanistic insights for designing advanced CO_2-to-CO molecular electrocatalysts.

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As featured in:

See Sumanta Kumar Padhi *et al.*, *Dalton Trans.*, 2025, **54**, 16682.

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