Metalloporphyrin Catalysed Photoelectrochemical Reduction of CO₂ at p-type Silicon Semiconducting Electrode

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Received: 7 October 2021 / Accepted: 19 November 2021 / Published: 6 December 2021

In the present study, the photoelectrocatalytic performance of a homogenous manganese(III) teraphenyl porphyrin (Mn(TPP)Cl) complex for carbon dioxide (CO₂) to carbon monoxide (CO) reduction has been evaluated. The electrocatalysis experiment was carried out at a Group IV (boron-doped p-type H-terminated silicon) semiconducting electrode in 0.1 M [NBu₄][BF₄]-MeCN electrolyte. The study was carried out at different concentration of the catalyst (0.05, 0.5 and 1 mM) and Brönsted acid (CF₃CH₂OH, 4-32 mM) under dark and illuminated (with polychromatic light) conditions. Results of the study indicated that the CO₂ reduction takes place at a much lower potential with appreciable current efficiency (48.2%) under illuminated conditions as compared to the dark condition. Besides, as compared to the previously studied carbon electrode system, the results are much better. Other than CO, molecular hydrogen generated as the second main product with current efficiency 42%.

Keywords: Carbon dioxide; Electrochemical reduction; Photoelectrocatalytic; Metalloporphyrin.

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