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Photocatalytic reduction of CO_2 by (Ni-ZnO)@C nanoreactors

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Nickel (Ni) and zinc oxide (ZnO) nanoparticles encapsulated in carbon-shell (Ni-ZnO)@C have been prepared for photocatalytic formation of valuable C1-C2 chemicals from CO_2 and H_2O. The (Ni-ZnO)@C nanoparticles having the Zn/Ni atomic ratios of 1-3 were synthesized by carbonization of Ni^{2+}- and Zn^{2+}-β-cyclodextrin at 573 K for two hours. Their component fitted XANES spectra indicate that nano Ni and ZnO are the main species in the (Ni-ZnO)@C. To increase the collision frequency of reactants (H_2O and CO_2) with the active sites (Ni and ZnO) within the carbon-shell, Ni and ZnO are partially etched from the (Ni-ZnO)@C with a H_2SO_4 solution (2N). By XRD and TEM, the sizes of the Ni and ZnO in (Ni-ZnO)@C are between 7-30 nm in diameter. Under the UV-Vis irradiation for five hours, yields of formic and acetic acids from the photocatalytic reduction of CO_2 and H_2O in the (Ni-ZnO)@C nanoreactors are 37.9 and 12.5 μmol/g/hr, respectively. It seems that ZnO involves in photocatalytic splitting of H_2O and provides hydrogen for catalytic hydrogenation of CO_2 on Ni to yield formic and acetic acids.

Biography

H Paul Wang has received his PhD degree in Chemical (Fuels) Engineering from University of Utah, Utah, USA. He is currently a Professor of Department of Environmental University, National Cheng Kung University, Taiwan. His research interest focuses on environmental nanotechnology, desalination and green energy. He has published more than 150 research papers.

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