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Materials science & engineering for carbon dioxide (CO_2) utilization

Photocatalytic reduction of CO_2 to fuel offers an exciting opportunity for helping to solve current energy and global warming problems. Although a number of solar active catalysts have been reported, most of them suffer from low product yield, instability, and low quantum efficiency. Therefore, the design and fabrication of highly active photocatalysts remains an unmet challenge. In the current work we utilize hydrogen-doped, blue-colored reduced titania for photocatalytic conversion of CO_2 into methane (CH_4). The photocatalyst is obtained by exposure of TiO_2 to $NaBH_4$ at 350 °C for 0.5 h. Sensitized with Pt nanoparticles, the material promotes solar spectrum photoconversion of CO_2 to CH_4 with an apparent quantum yield of 12.40% and a time normalized CH_4 generation rate of 80.35 µmol g^{-1} h^{-1}, which to the best of our knowledge is a record for photocatalytic-based CO_2 reduction. The material appears intrinsically stable, with no loss in sample performance over five 6 h cycles, with the sample heated in vacuum after each cycle.

Speaker Biography

Professor SU-IL IN has been working at DGIST since 2012. He served the Dean of External and International Affairs at DGIST (Daegu Gyeongbuk Institute of Science and Technology) in 2016~2017. He received his Ph.D. in Chemistry from the University of Cambridge in 2008. He then became a postdoctoral research associate at the Technical University of Denmark in 2010. He also joined the Department of Chemistry at Pennsylvania State University as a postdoctoral fellow before joining DGIST. Professor In's current researches include synthesis and analysis of functional nano (bio)-materials for environmentally friendly renewable energy such as photovoltaic, heterogeneous catalysis and biocatalysts. A central goal of this work is relating surface structure/properties, size and composition to the catalytic activity and microbial fuel cell (MFC).

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