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ENERGYPOLIS SEMINAR

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CO_2 conversion to oxygenate fuels using nanocomposite photocatalysts

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As we know, conversion of CO_2 to oxygenate fuels in the presence of photocatalysts is a promising route for sequestration of environmental concern (increasing the amount of CO_2) and depletion of fossil fuels and high demand for energy. So far in this field, we have worked under two nanocomposite systems including CNT/ZnO-CuO [1] and Pd/TiO_2-Fe_2O_3 [2]. CNT/ZnO-CuO as a p-n junction system applied as an efficient photocatalyst for photochemical conversion of CO_2 to ethanol, oxalic acid and formaldehyde. For each photosynthetic product, a reaction scheme was proposed on the basis of physicochemical phenomena. In the second work, Pd/TiO_2-Fe_2O_3 was employed in the CO_2 photoreduction (hydrogenation) process and various oxygenate (C/H/O) products [including ethanol, methanol and formaldehyde as well as oxalic, acetic and formic acids] were synthesized in the reaction medium. After that, through photoelectrochemical studies of the solar-energy-materials, the photon-to-electron conversion ability of the photocatalysts was examined. Finally, the matter of CO_2 photoconversion into oxygenate fuels/chemicals was explained in detail from photoelectrochemical [semiconductor band structure and redox potential] as well as mechanistic perspectives. Our present study focus on CO_2 photoreduction under CNT/Fe_2O_3/NiO nanocomposite, this semiconductor is mesoporous and a p-n junction system, which we predict that in the presence of it, the charge recombination will reduce and cause a conspicuous increase in the photocurrent and an obvious increment in the total yield of the photosynthesized products. Finally we are going to analysis the products and propose a mechanism for various products being produced at a fixed reaction period. My further works include photo conversion of CO_2 using efficient photocatalyst (high surface area, mesoporous, nanostructured with high absorbance for CO_2 and visible light photocurrent and low impedance from oxides group including C, N, Ni Co elements) and apply it for photoconversion of CO_2 and finally analysis the product in both gas and liquid phase.

References:

[1] M. Lashgari, S. Soodi, P. Zeinalkhani, "Photocatalytic back-conversion of CO_2 into oxygenate fuels using an efficient ZnO/CuO/carbon nanotube solar-energy-material: Artificial photosynthesis", *Journal of CO_2. Utilization*, vol.18, pp. 89-97, 2017

[2] M. Lashgari, S.Soodi, "Photocatalytic conversion of CO2 into oxygenate fuels/chemicals using efficient, eco-friendly, nanostructured solar-energy materials", *Journal of nanoscience and nanotechnology, 2018 (submitted)*

CV: Sanaz Soodi

Born in 1998 in Zanjan, Iran, Sanaz Soodi graduated with a BSc in Chemistry from the university of Zanjan in 2011 and MSc. in Physical Chemistry from the Institute for Advanced Studies in Basic Sciences in 2015. During her MSc she worked on hydrothermal synthesis of CNT/ZnO-CuO and ZnO-CuO nanocomposites and their application in CO_2 photo reduction to fuels. During her PhD she is working on the synthesis of various metal oxide semiconductors and their application in CO_2 photo conversion to oxygenate fuels such as ethanol, oxalic acid, formic acid and so on.