ICCDU XVI
27-30 August, 2018
Rio de Janeiro, Brazil

16th INTERNATIONAL CONFERENCE ON CARBON DIOXIDE UTILIZATION

# $CO_2$ Conversion by Highly-Ordered Mesoporous Photocatalysts

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*Keywords: Carbon dioxide, Solar Fuels, Photocatalyst, Selectivity, $CO_2$ Conversion*

In order to decrease $CO_2$ emission, solar fuels are one of the most important candidates for alternative energy sources to fossil fuels. A major goal in this field is to realize an artificial leaf – a material that converts light energy in the form of solar photons into chemical energy – using $CO_2$ as a feedstock to generate useful chemical species[1]. Enabling this technology will allow the greenhouse gas emitted from energy production and manufacturing exhaust streams to be converted into valuable products such as solar fuels or chemical feedstock, thereby creating huge economic and environmental benefits by simultaneously addressing energy security and climate change issues. Extensive research efforts with respect to the artificial leaf have been focused on water splitting, while the photocatalytic reduction of $CO_2$ remains a significant challenge due to its low conversion efficiency and selectivity[2,3]. To deal with this, we focus on the mesoporous compound semiconductor photocatalysts which have reasonable physical and optical properties. In this study, we successfully synthesized two-types of highly-ordered mesoporous cadmium sulfide impregnated photocatalysts with different dimensions of pore orderings. These mesoporous cadmium photocatalysts are directly synthesized by the cooperative assembly of cadmium sulfate as a single precursor and organic surfactants *via* a nano-replication and etching processes. The physicochemical properties of replicated photocatalysts with crystalline frameworks are characterized by TEM, XRD, UV-vis spectroscopy. $CO_2$ conversion experiment utilizing the synthesized photocatalysts are conducted through the experimental setup as shown the Fig.1. The $CO_2$ conversion efficiency is analyzed by the gas chromatography with FID and TCD. The experimental results show that cadmium sulfide impregnated mesoporous photocatalysts have good selectivity and conversion efficiency. It is also found that the conversion efficiency of two different photocatalyst with different pore orderings are different under the same conditions.

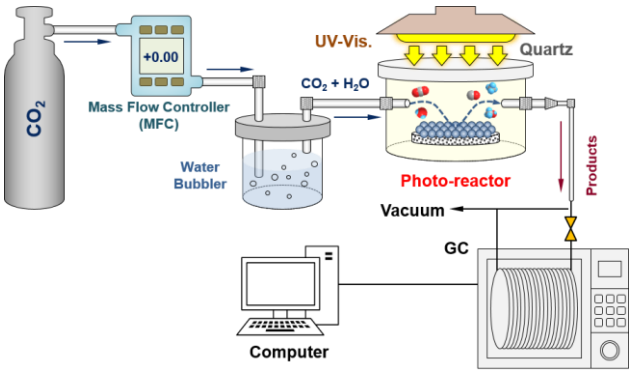


**Figure 1.** Experimental setup for photocatalytic conversion of $CO_2$

## Acknowledgments

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (Grant number: 2016R1A2B3007577) and supported by Korea University Future Research Grant.

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