عنوان مقاله:

CO2 utilization and catalytic conversion to valuable products

محل انتشار:

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نویسنده:

Kaveh Kalantari - *Department of Chemical Engineering, Faculty of Engineering, University of Zanjan, Zanjan, Iran*

خلاصه مقاله:

CO2 remained a key air pollutant vehemently emitted from many anthropogenic activities (including the fossil fuel usage). The increasing amount of anthropogenic CO2 emissions is a global concern. Reducing the amount of CO2 in the atmosphere could reduce the greenhouse effect, but this requires individuals and companies to change their behavior, which in turn requires economic and social incentives. Moving away from fossil fuels to cleaner energy sources remains a big challenge. Scientists have been studying methods for reducing CO2 emissions for decades. Capturing CO2, either from flue gases of industrial processes or directly from the atmosphere, is one such option. Yet carbon capture and storage (CCS) presents technical and economic barriers [1]. The concept of CO2 capture and utilization (CCU) is prioritized by both researchers and industries. CO2 utilization itself should be divided into two parts. First, CO2 alone without any conversion has certain uses, such as, enhanced the oil recovery by CO2 flooding, physical solvent applications especially in the supercritical state or can be directly applied in various industries such as soft drinks, food, agro-chemistry, welding, foaming, fire-extinguishers, etc. Secondly, CO2 can be converted to chemicals such as methanol, ethanol and C1–C11 hydrocarbons and energy via catalytic conversion. There are indications that the CCU option is seriously attracting great momentum, with its applications toward industrialization expected in the near future. In fact, the applications of CCU are numerous [2]. The use of CO2 to chemicals and energy products that is currently produced from fossil fuels is promising due to the high benefits and potential market. Currently, numerous methods have been employed for catalytic CO2 conversion through homogeneous and heterogeneous catalytic reaction such as photocatalytic reaction, electrochemical conversion, CO2 hydrogenation, carboxylation, solar thermochemical CO2 splitting and dry reforming [3]. Electrochemical technique reduces CO2 into value added chemicals using high power electrical energy, however, lower efficiency and electrode stability limit the process efficiency. Photocatalytic technique, artificial photosynthesis, is the conversion of CO2 and water into solar fuels like CH4, CO, methanol (CH3OH), formic acid (HCOOH) and formaldehyde (HCHO) under solar light irradiations. Various photocatalysts including zinc oxide (ZnO), tungsten oxide (WO3), gallium phosphide (GaP), ... gallium oxide (Ga2O3), zirconium oxide (ZrO2), zinc sulfide (ZnS), cadmium sulfide (CdS), bismuth su

کلمات کلیدی:

CO2 utilization, photocatalytic reduction, catalytic hydrogenation, dry reforming, catalyst