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Enhancing Solar Fuel Production by CO_2 Photoreduction Using Transition Metal Oxide Catalysts in Reactors Prepared by Additive Manufacturing

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Abstract : There is a huge global concern due to the emission of greenhouse gases, consequent environmental problems, and the increase in the average temperature of the planet, caused mainly by fossil fuels, petroleum derivatives represent a big part. One of the main greenhouse gases, in terms of volume, is CO_2. Recovering a part of this product through chemical reactions that use sunlight as an energy source and even producing renewable fuel (such as ethane, methane, ethanol, among others) is a great opportunity. The process of artificial photosynthesis, through the conversion of CO_2 and H_2O into organic products and oxygen using a metallic oxide catalyst, and incidence of sunlight, is one of the promising solutions. Therefore, this research is of great relevance. To this reaction take place efficiently, an optimized reactor was developed through simulation and prior analysis so that the geometry of the internal channel is an efficient route and allows the reaction to happen, in a controlled and optimized way, in flow continuously and offering the least possible resistance. The design of this reactor prototype can be made in different materials, such as polymers, ceramics and metals, and made through different processes, such as additive manufacturing (3D printer), CNC, among others. To carry out the photocatalysis in the reactors, different types of catalysts will be used, such as ZnO deposited by spray pyrolysis in the lighting window, probably modified ZnO, TiO_2 and modified TiO_2, among others, aiming to increase the production of organic molecules, with the lowest possible energy.

Keywords : artificial photosynthesis, CO_2 reduction, photocatalysis, photoreactor design, 3D printed reactors, solar fuels
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