

## IS CARBON DIOXIDE NO LONGER WASTE THANKS TO THE PHOTOCATALYSIS?

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Carbon dioxide was considered for a waste for many decades. It is an abundant source of carbon which should be utilized. However, it is no easy task. One way to transform CO<sub>2</sub> into other useful products is photocatalytic reduction. Photocatalytic reduction of CO<sub>2</sub> is sometimes called artificial photosynthesis and the idea is if it works in the nature why not to reproduce it for ours benefit.

The huge advantage of the photocatalytic reactions is that they proceed under mild conditions, room temperature and pressure. Cheap semiconductor materials are used as photocatalysts, for example TiO<sub>2</sub>. The disadvantage is that TiO<sub>2</sub> requires UV light for activation and there is small amount of UV in solar light. Therefore, effort is focused on broadening the spectrum range, in which TiO<sub>2</sub> is capable to absorb light. The main goal is to utilize solar light as the driving force.

The photocatalytic reduction of CO<sub>2</sub> has to be carried out in the presence of reducing agent. The cheapest reducing agent is water and there are a variety of possible products depending on used photocatalyst. The most common products are methane, carbon monoxide and hydrogen in gas phase and methanol in liquid phase. Most of the products can be further used as an energy source or in chemical industry. It looks very exciting, minimum energy input (if solar light is used), removal of carbon dioxide (the main Global warming gas) and as a result we get energy source.

Unfortunately, the heterogeneous CO<sub>2</sub> photocatalytic reduction on semiconductor photocatalysts is not ready yet to be carried out in real-life applications, there are many drawbacks that need to be addressed and extensive further research is necessary. Nevertheless, with the present rate of developments in the area, the emerging understanding of the mechanism, as well as new extraordinary materials it should bring the promise held by this process much closer to the accomplishment in the near future.