# Photocatalytic reduction at dislocations

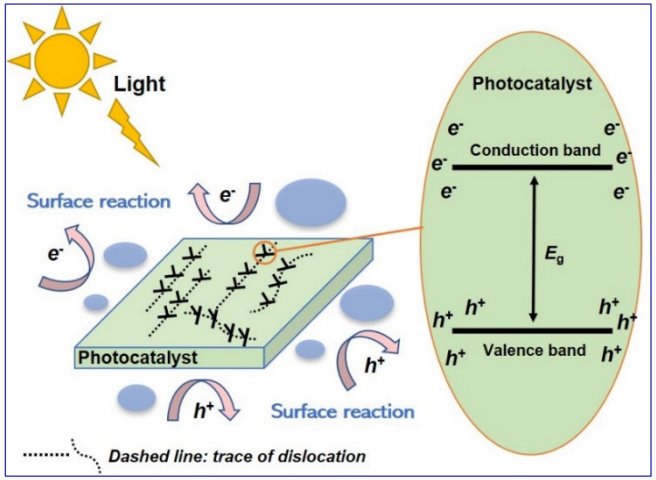
Enhancement of conversion of light to chemical energy by catalysis with dislocation-rich metal oxides

## STATUS QUO

The direct use of light to synthesize high energy chemicals is important for efficient energy storage. However, no appropriate solution, e.g., to catalytic $H_2O_2$ production and $CO_2$ reduction could be established. The currently achieved products on lab scale are mostly one-carbon ($C_1$) compounds. Direct conversion into multi-carbon ($C_{2+}$) compounds, especially liquid products, which are easily stored and separated from the educts, is one of the major goals.

## OUR TECHNOLOGY

Using methods to control dislocation type and density in metal oxide ceramic material, the functional properties of these compounds can be significantly modified. Multiple ceramics with high dislocation density can promote photocatalysis of $H_2O_2$ production and even $CO_2$ reduction. Not only is the expected yield of the products higher by multiple factors. The $CO_2$ reduction results preferentially in liquid $C_{2+}$ products. These can be better stored and separated and are hence more interesting for industrial applications.




## BENEFITS

- ► Efficient production of high-value chemicals
- ► Sustainable reaction with only water, $CO_2$, and catalyst
- ► Low-cost separation of liquid products

## APPLICATION POSSIBILITIES

The solution is expected to appeal to the chemical industry for sustainable production of organic base chemicals or efficient synthesis of e-fuels.

## COMMERCIALIZATION OPPORTUNITIES

There are various possibilities for cooperation between the industrial partner and TU Darmstadt: from an exchange with the know-how carriers of the technology up to a close cooperation in case of further development needs. The technology is protected by intellectual property rights and can be used by the industry partner after a sale or licensing agreement.

## CURRENT STAGE OF DEVELOPMENT TECHNOLOGY READINESS LEVEL (TRL)

| | |
|---|---|
| 9 | Product ready to launch |
| 8 | |
| 7 | Prototype |
| 6 | |
| 5 | |
| **4** | |
| 3 | Proof of Concept |
| 2 | |
| 1 | Idea |

The technology development is at Level 4: We successfully obtained a proof of concept and are on the way to promote the development beyond lab scale

## YOUR CONTACT PARTNERS AT TU DARMSTADT

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