# Splitting Water with Sunlight

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Hydrogen is one of the most important fuels of the future, and the sun will be one of our most important sources of energy. Why not combine the two to produce hydrogen directly from solar energy without any detours involving electrical current? Why not use a process similar to the photosynthesis used by plants to convert sunlight directly into chemical energy?

Researchers from the German Max Planck Institute have now developed a catalyst that may do just that. As they report in the journal *Angewandte Chemie*, titanium disilicide splits water into hydrogen and oxygen. And the semiconductor doesn't just act as a photocatalyst, it also stores the gases produced, which allows an elegant separation of hydrogen and oxygen.

"The generation of hydrogen and oxygen from water by means of semiconductors is an important contribution to the use of solar energy," explains Martin Demuth (of the Max Planck Institute for Bioinorganic Chemistry in Mülheim an der Ruhr). "Semiconductors suitable for use as photocatalysts have been difficult to obtain, have unfavorable light-absorption characteristics, or decompose during the reaction."

Demuth and his team have now proposed a class of semiconductors that have not been used for this purpose before: Silicides. For a semiconductor, titanium disilicide (TiSi2) has very unusual optoelectronic properties that are ideal for use in solar technology. In addition, this material absorbs light over a wide range of the solar spectrum, is easily obtained, and is inexpensive.

At the start of the reaction, a slight formation of oxide on the titanium disilicide results in the formation of the requisite catalytically active centers. “Our catalyst splits water with a higher efficiency than most of the other semiconductor systems that also operate using visible light,” says Demuth.

One aspect of this system that is particularly interesting is the simultaneous reversible storage of hydrogen. The storage capacity of titanium disilicide is smaller than the usual storage materials, but it is technically simpler. Most importantly, significantly lower temperatures are sufficient to release the stored hydrogen.

The oxygen is stored as well, but is released under different conditions than the hydrogen. It requires temperatures over 100°C and darkness. “This gives us an elegant method for the easy and clean separation of the gases,” explains Demuth. He and his German, American, and Norwegian partners have founded a company in Lörrach, Germany, for the further development and marketing of the proprietary processes.

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