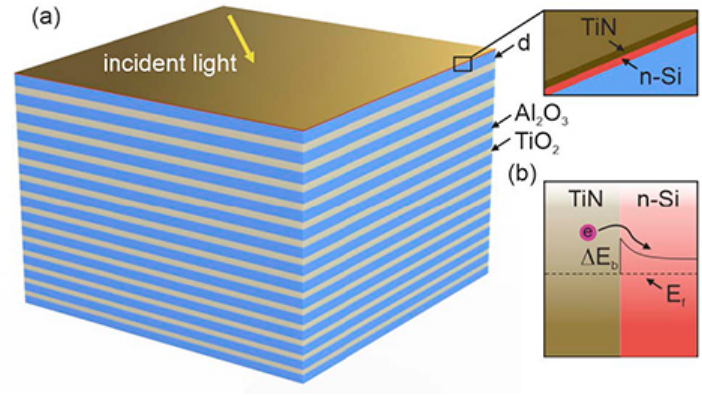
SibFU Scientists Use Solar Power to Produce Hydrogen

SibFU researchers together with researchers from Krasnoyarsk Research Centre have developed a new design for an electrode of a light-induced cell for water splitting.



A focus on the search for renewable energy sources is increasing due to the inevitable depletion of fossil fuel reserves, and methods involving solar energy are of particular interest for researchers. Today there are two primary lines of research: the development of solar batteries that convert sunlight directly into electricity, and the development of ways to convert solar power into the energy of chemical energy carriers (for example, hydrogen). Free hydrogen can not be found in natural sources, so it must be obtained from hydrogen-containing compounds. This problem can be solved by using sunlight to decompose water into hydrogen and oxygen.

The process of photoelectrochemical water splitting begins with the absorption of solar radiation. The amount of hydrogen released is tied to the amount of absorbed light, so increasing the rate of absorption by cell electrodes has become the main issue. It is proven that the so-called Tamm plasmon polariton demonstrates some absorbing capacity. This is a special state of light that occurs when it is localised at the boundary of a multilayer and metal mirrors.

A special design proposed by the scientist is based on a chirped photonic crystal (a crystal whose geometric parameters vary with the layer number) and a thin layer of titanium nitride separated by a semiconductor layer. Titanium nitride acts as a metal mirror, and a broad band appears in the absorption spectrum of the structure.

> *"We have managed to show that when a mirror with a constant period is replaced with a chirped mirror with a varying period the properties of the structure are significantly improved. As a result, the integral absorption increases by 8% in the range from 700 nm to 1400 nm, photoresponsivity reaches 32.1 mA/W, and the estimated efficiency of the structure is 3.95%. We believe that these results are decent,"* says **Maxim Pyatnov**, researcher at the Laboratory of Nanotechnology, Spectroscopy and Quantum Chemistry of SibFU.

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