"Nanoengineering of active sites in carbon nitride for single-atom heterogeneous photocatalysis"

POPULAR ABSTRACT

The dynamic development of civilization, the fight against increasing environmental pollution, and global warming are opposing directions that are often impossible to reconcile. Chemical technologies, especially those related to fuel production, urgently need to be improved. It is necessary to look for new environmentally friendly solutions in the spirit of sustainable development but also economically viable. The project entitled "Nanoengineering of active sites in carbon nitride for single-atom heterogeneous photocatalysis" is aimed at searching for such solutions.

Catalysts are commonly used for the technological processing of raw materials, thanks to which chemical reactions take place faster and at lower temperatures, thus using less energy. However, these processes usually require heating, which consumes electricity. If we carry out the process photocatalytically, we only need light energy to power the process. If we use solar radiation for this purpose, this technology is not only cheaper but also more environmentally friendly. Unfortunately, currently known photocatalysts are still inefficient, and most of them operate only under irradiation with UV light, which constitutes only about 4% of the solar spectrum.

The project aims to produce and study the latest class of materials – separated single metal atoms localized on a semiconductor matrix – to indicate their potential application, which can later be used in practice. Carbon nitride was chosen as the semiconductor, as it is activated by visible light, but without additional modifications, it is too ineffective. However, it is characterized by an ordered chemical structure with places where individual metal atoms can be located and stabilized. These metals can accumulate solar energy converted by the semiconductor and use it to carry out chemical transformation of molecules adsorbed at them. Working on an atomic scale not only enables lower consumption of metal as a raw material (low costs) but also benefits from new properties that are offered only by such systems. This type of material can appear very promising *inter alia* for the production of so-called solar fuels.

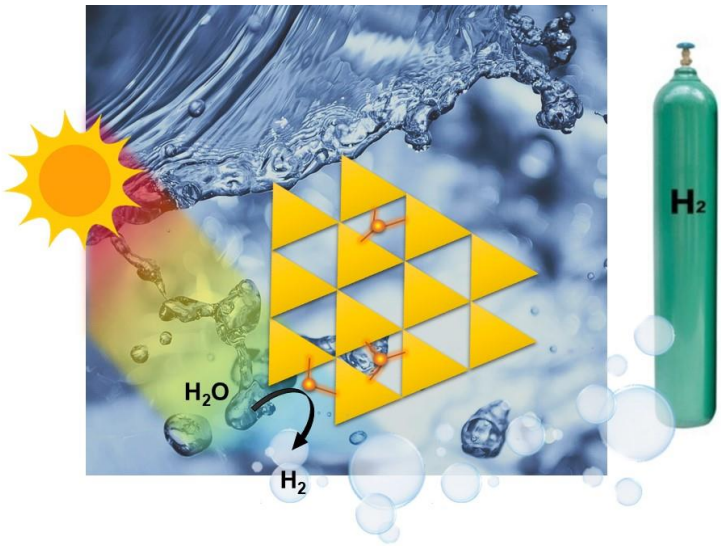

Fig. An example of the use of heterogeneous photocatalysis on single atoms to produce fuel (hydrogen) from water using sunlight.