A Promising New Way to Convert Solar Energy to Fuel

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An INRS team has developed a promising solution to enhance solar energy-fuel conversion.

Solar fuel allows to store and transport solar energy, while overcoming the variability of this intermittent renewable resource. However, the conversion of clean solar energy to fuel has some limitations. The team of Professor Dongling Ma of the Institut national de la recherche scientifique (INRS), in collaboration with Professors Aycan Yurtsever and Mohamed Chaker, has developed a promising solution. Their results were published in the journal Nature communications.

Converting energy to fuel is one of the promising and up-and-coming applications of metal–organic frameworks (MOF). This class of emerging crystalline polymers that absorbs photons from sunlight can be used in solar technology. The photon energy separates an electron (negative charge) from a hole (positive charge). If they recombine before they participate in oxidation and reduction reactions, the energy is lost and photocatalytic efficiency will be rather low. The fast recombination of charge carriers in these frameworks is the most significant limitation for their photocatalytic application.

The Advantage of Homojunctions

According to Professor Dongling Ma, homojunctions could overcome this inherent limitation. Made of semiconductors with analogous composition, homojunctions have attracted more and more attention for their superior capability of promoting charge separation.

Her team achieved the well-defined MOF homojunction by developing an easy one-pot

synthesis route. They used hollow gold and silver nanocubes to induce the growth of the MOF in one-step. The MOF homojunction is composed of two stacked concentric MOF nanoplates, with the same orientation and uniform size.

“Our work provides a powerful platform to synthesize proficient MOF complexes and sheds light on the hierarchical structure-function relationships of MOFs,” Professor Ma says. “It opens the door to more effective conversion of solar energy to fuel, in order to replace oil and gas.”

Read the original article on Institut national de la recherche scientifique (INRS).