Nano Science, Technology and Industry Scoreboard

Solar-driven Chemistry One Step Closer to Reality

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Scientists at the University of Helsinki offer new insights onto the control over reaction selectivity with visible light in plasmonic catalysis.

In this discovery, it was found that by engineering the composition in nanoparticles containing Ag and Pd, visible light irradiation could be employed as a sustainable energy input not only to accelerate molecular transformations but also to enable control over reaction selectivity. For example, by employing the hydrogenation of phenylacetylene as a model transformation, scientist demonstrate that visible-light irradiation can be employed to steer the reaction pathway from hydrogenation to homocoupling, changing the nature of the products that are generated with and without visible light illumination. The results have been published in the science journal Angewandte Chemie.

"This is an exciting discovery," said professor Pedro Camargo from the University of Helsinki, who led the study. "The control over reaction selectivity with visible-light through plasmonic catalysis can pave the way for more sustainable and efficient chemical processes."

The use of visible light to accelerate chemical reactions via plasmonic catalysis offers unique opportunities to achieve much milder reaction conditions relative to reactions conventionally carried out under external heating and high pressure, for example.

Reaction selectivity in nanocatalysis remains challenging

Plasmonic catalysis involves using the collective oscillations of electrons in metal nanoparticles to enhance chemical reactions. This approach has been widely studied due to its potential for reducing the amount of energy required to drive chemical reactions and increasing reaction rates.

Catalysis plays a central role in our society. It refers to the acceleration of molecular transformations in the presence of a catalyst, which enabled faster chemical reactions but is not consumed in the reaction itself. The use of nanoparticles as catalysts (aka, nanocatalysis) impacts the production of a wide range of products, from fuels to chemicals and pharmaceuticals. In this context, more efficient catalytic process can not only lower environmental impacts but also increase access to essential products for people all over the world.

Controlling reaction selectivity in nanocatalysis is crucial because, in many cases, a reaction can produce multiple products. Some of these may be unwanted or have less value. If we could control reaction selectivity, we could enable the formation of a desired product, making processes more efficient and cost-effective process while avoiding extra steps of purification and decreasing the generation of waste. Thus, control over selectivity saves time, resources, and energy. Despite its very attractive features, the control over reaction selectivity in nanocatalysis remains challenging.

Read the original article on University of Helsinki.