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Synthesizing hydrocarbons from carbon dioxide and water with metal nanostructures and solar energy

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For many years, researchers had endeavored to replicate natural photosynthesis converting carbon dioxide and water to hydrocarbons and carbohydrates. In their approaches, the efficiency of solar energy storage was very low and there had been no significant progress towards large-scale and highly efficient artificial photosynthesis. Pulsed laser-assisted etching is a simple but effective method for making small regular structures directly onto a solid surface. We have successfully fabricated sub micro- or nano-meter sized structures on different solid surfaces immersed in liquids with femtosecond laser pulse irradiations. We can control the experimental conditions to design and make nanostructures in different materials and on the surfaces with different morphologies. We have combined the plasmonic and the catalytic properties of metal nanostructures to obtain an efficient artificial photosynthesis, converting carbon dioxide and water into hydrocarbons for solar energy storage. In our experiments, we have discovered a highly efficient artificial photosynthetic process that utilizes cobalt (Co) or iron (Fe) nanostructures formed by the femtosecond laser pulse irradiation. The details of this discovery will be introduced and discussed in the talk.

Biography

Mengyan Shen is an Associate Professor of Physics at University of Massachusetts Lowell. He obtained his PhD from University of Science and Technology of China in 1990, and his MS and BS from Inner Mongolia University in 1987 and 1984, respectively. He has published about 100 research papers. He has served as reviewers for different journals and foundations. In September 2006, he resigned his faculty position at Tohoku University and joined University of Massachusetts Lowell to further develop nano manufacturing techniques using intense femtosecond laser pulses together with students and fellow researchers. In addition to research work, he has experience teaching and leading experiments for undergraduate and graduate students in China, Japan and United States.

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