Technology Can Be Used to Store Solar Energy

We all learned about photosynthesis in high-school biology. It's the process by which plants, algae and many forms of bacteria use energy from sunlight to convert carbon dioxide and water into organic compounds while releasing oxygen as byproduct.

The amount of energy trapped by photosynthesis on Earth is tremendous it's estimated to be about 100 trillion watts every year.

Researchers at UMass Lowell are now able to replicate photosynthesis in the laboratory, with the goal of someday storing solar energy on a commercial scale to help alleviate global energy need and reduce high concentrations of carbon dioxide in the atmosphere.

"Sunlight is a renewable and environment-friendly energy source that could potentially become the ultimate global energy solution," says physics Assoc. Prof. Mengyan Shen, head of the University's Laboratory for Nanoscience and Laser Applications.

Shen and graduate students Cong Wang, Haibin Huo, Haizhou Ren, Fadong Yan and Michael Johnson employ novel nanostructure arrays on solid metal surfaces to convert carbon dioxide and water into hydro-carbon and carbohydrate compounds for storing

solar energy. The team utilizes intense laser pulses to irradiate the surfaces of cobalt and iron microparticles and induce the formation of the nanostructure arrays.

“Photosynthesis involves dissociating carbon dioxide into carbon monoxide and oxygen, and water into hydrogen and oxygen, and then synthesizing hydrocarbons from the hydrogen and carbon monoxide,” says Shen. “With metal nanostructures formed with femtosecond laser irradiation, a nature-like photosynthesis can be easily achieved and maintained at low cost using Earth-abundant metals.”

He says the efficiency for storing solar energy using the group’s present simple experimental setup is about 10 percent, which they hope to improve even further.

“Our setup is functioning stably and continuously without extra equipment and with sunlight as the only energy source,” he says. “Considering the high hydrocarbon production rate and solar-energy storing efficiency of the artificial photosynthesis, these nanostructure arrays open various new avenues for ing renewable energy sources and developing carbon recycling in the future.”

The team’s research has been partially supported by a one-year $60,000 seed grant from the National Science Foundation Center for High-Rate Nanomanufacturing at UMass Lowell and the Massachusetts Technology Collaborative. Its findings were published last winter in the "International Journal of Modern Physics."

more information about the team’s work, visit