Multiple-absorbers offer increased solar conversion efficiencies for artificial photosynthesis

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BRIEF DESCRIPTION

Researchers at UCI have, for the first time, developed a method for modeling the efficiencies of artificial photosynthetic devices containing multiple light absorbers. As these devices more closely parallel naturally occurring photosynthesis, they offer higher performance than standard single-absorber devices.

FULL DESCRIPTION

Solar devices have exploded in popularity in recent years due to both the abundance of sunlight and the eco-friendly alternative they offer to fossil fuel consumption. While the most popular have been solar cells that convert sunlight directly into electricity, such devices have several drawbacks which have thus far limited their widespread adoption. Most notably, electricity is produced instantaneously in solar cells which complicates the storage and distribution of power. While significant work has been dedicated to storing solar electricity, many researchers have instead turned to investigating artificial photosynthesis. Artificial photosynthesis (AP) aims to mimic the natural process of photosynthesis by converting solar photon energy into usable chemical energy. This energy is in the form of chemical bonds, i.e. – solar fuel, which can be easily stored and distributed as needed. Despite their promise, AP devices have still been somewhat limited in application due to their relatively low energy conversion efficiency limits (ECEL), which determines how much usable energy is produced by the system given the initial energy input.

To improve the ECEL of AP devices, researchers at UCI have developed a novel model geometry that more closely mimics the natural photosynthesis that occurs in plants. The geometry here consists of a vertical stack of identical absorbing units, with as many as 128 layers included in the model. When these absorbers are allowed to radiatively couple, researchers find that the ECEL of the device is 23%, 4% higher than that of a single absorber. These findings establish such coupled-absorber schemes as a promising and lucrative alternative to the standard monolithic AP device.

SUGGESTED USES

For determining the energy-conversion efficiency limit in solar photochemical devices

ADVANTAGES

» ***Straightforward***: The model used here is relatively straightforward – it relies on established physical laws and equations.

» ***Efficient***: The multiple-absorber geometry presented by the researchers offers an increased solar-to-fuel conversion efficiency (23%) compared to single-absorber constructions (19%).

PATENT STATUS

Country	Type	Number	Dated	Case

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OTHER INFORMATION

CATEGORIZED AS

» **Optics and Photonics**
» All Optics and Photonics
» **Energy**
» Solar
» **Materials & Chemicals**
» Thin Films
» **Semiconductors**
» Other

RELATED CASES

2019-365-0

United States Of America	Issued Patent	11,912,589	02/27/2024	2019-365	

Additional Patent Pending

STATE OF DEVELOPMENT

In development. While the simulations have been performed, researchers are now searching for a suitable system to use in real-world tests

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