

# Artificial solar power generation in the absence of oxygen

What are artificial solar energy technologies?

Artificial solar energy technologies mostly rely on purely inorganic materials, such as silicon and perovskite photovoltaic cells, for power generation 4. These systems can be coupled to electrocatalysts (often made from non-abundant elements) to perform redox reactions and chemical transformations 5, 6.

What is 'artificial photosynthesis'?

This field of research, called "artificial photosynthesis," is currently the subject of intense interest, driven by the aim of converting solar energy into the carbon-free fuel hydrogen through the light-driven water splitting.

How do artificial photosynthesis devices use solar energy?

Artificial photosynthesis devices involving semiconductors can absorb solar energy and store it by converting in the form of chemical energy which can be used later.

How do engineered algae produce energy?

The engineered algae exhibit bioelectrogenesis, en route to energy storage in hydrogen. Notably, fuel formation requires no additives or external bias other than CO<sub>2</sub> and sunlight. The cellular power stations autoregulate the oxygen level during artificial photosynthesis, granting immediate utility of the photosynthetic hydrogen without separation.

Can solar energy be converted into chemical energy?

Conversion of solar energy into chemical energy through the light-driven water splitting indeed generates the environmentally benign oxygen gas and hydrogen, a carbon-free fuel with the highest energy output relative to molecular weight.

What is Artificial Photosynthesis System (APS)?

Artificial photosynthesis system (APS) imitates the fundamental process of photosynthesis taking place in organisms for our societal needs. APS captures as well as stores solar energy in the form of fuel rather than glucose and is able to meet both the challenges of being carbon-negative and a source of solar fuel (Figure 1).

Interfacing biotic components with abiotic entities on electrodes has gained considerable interest for power generation, the production of fuels and chemicals, but also for sensing. 1, 2 Particularly, the coupling of photoactive ...

The processes include photoelectrochemical hydrogen generation, solar thermochemical hydrogen generation, photovoltaic or concentrating solar power for electricity production, electrolysis of water to ...

Artificial photosynthesis and solar panels harness the sun's power, but both offer distinct advantages and cater

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to different energy needs, carving their unique niches in renewable energy technologies. Artificial ...

Aquaculture systems are characterized by a very high energy input, mainly due to their need for artificial oxygen supply. The electric power generation using floating, elevated, ...

Artificial photosynthesis system (APS) uses biomimetic systems to duplicate the process of natural photosynthesis that utilizes copious resources of water, carbon dioxide and sunlight to produce oxygen and energy-rich ...

An artificial leaf can perform direct solar-to-fuels conversion. The construction of an efficient artificial leaf or other photovoltaic (PV)-photoelectrochemical device requires that ...

Researchers at the Swiss Federal Institute of Technology broke through the 1-kilowatt ceiling of green hydrogen generation using solar energy. The system turns solar power into hydrogen, oxygen ...

Humans have tried tapping into this resource with solar panels, but plants already have it figured out, using sunlight to power photosynthesis and convert CO<sub>2</sub> and water into oxygen and ...

Significantly, when these leaves are connected in series within the artificial plant structure, the system produces an OCV of 2.7 V and a maximum power of 140 mW, which is ...

Electrons from different photosynthetic electron transport chains can be rewired to new-to-nature pathways, creating biotechnologies for solar-powered electricity generation ...

Oxygenic photosynthesis is the primary solar energy-conversion process that supports much of life on Earth. It is initiated by photosystem II (PSII), an enzyme that extracts electrons from H...

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