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AN ARTIFICIAL LEAF THAT WILL PRODUCE FUEL

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Анотація.
У статті розглядається технологія створення штучного листка, який може перетворювати сонячну енергію в електричну енергію. Такі пристрої використовують напівпровідникові матеріали, що взаємодіють з сонячним випромінюванням, для створення електронних струмів і дірок. Ці струми рухаються до різних електродів, створюючи електричний потенціал, який може бути використаний для живлення різних пристроїв. Також описується нова технологія, яка дозволяє утримувати вуглекислий газ і перетворювати його в синтетичне паливо.
Ключові слова: штучний лист, сонячна енергія, синтетичне паливо, продуктивність, обробка вуглекислого газу.

Abstract.
The article discusses the technology of creating an artificial leaf that can convert solar energy into electrical energy. Such devices use semiconductor materials that interact with solar radiation to create electron currents and holes. These currents move towards different electrodes, creating an electric potential that can power various devices. The article also describes a new technology that allows for the capture and conversion of carbon dioxide into synthetic fuel.
Keywords: artificial leaf, solar energy, synthetic fuel, productivity, carbon dioxide processing.

Introduction

An artificial leaf is a device that can convert sunlight into electrical energy. Such devices are also called photovoltaic elements or solar cells. They are used to collect and store electric energy from solar radiation. The main components of an artificial leaf are semiconductor materials such as silicon, cadmium, and arsenide telluride, which interact with solar radiation to create electron currents and holes.

These electrons and holes move towards different electrodes located at each end of the artificial leaf, creating a potential at electrical contacts where electrons can be collected and sent to the external circuit. Modern artificial leaves have great potential in the fields of renewable energy and electronics, as they can provide electrical energy for various devices without the use of fuel or other harmful sources of energy.

Research results

The engineering team has developed a system that captures carbon dioxide 100 times faster than other modern technologies.

Over the years, many artificial leaf systems have been created that use sunlight to convert water into liquid fuel and electricity. One interesting example was presented by engineers at the University of Illinois at Chicago (UIC) in 2019. According to the creators, it had a unique design that made it suitable for real-world use, unlike other laboratory solutions that could only work with carbon dioxide from pressurized tanks. The solution consisted of a standard artificial photosynthesis unit that was placed inside a transparent capsule filled with water and had a semi-permeable outer layer.

When sunlight hit the device, water evaporated through pores in the outer layer, and carbon dioxide was drawn in instead, which the internal unit converted into carbon oxide. This CO can then be captured and used to produce synthetic fuel.

Thanks to some key changes in the design, scientists raised its productivity to a new level. The team used inexpensive materials to integrate an electrically charged membrane that acts as a water gradient, both with a dry and wet side. On the dry side, an organic solvent attaches to the captured carbon dioxide and converts it into concentrated bicarbonate, which accumulates on the membrane.

The positively charged electrode on the wet side then allows the bicarbonate to pass through the membrane into the aqueous solution, where it is converted back into carbon dioxide for fuel production or other purposes. Changing the electrical charge can accelerate or slow down the speed of carbon capture, which the scientist found can capture 3.3 millimoles per hour for every four square centimeters of material under optimal conditions.

According to the team, this result is more than 100 times better than existing analogs. It is essential to note that only a small amount of energy, 0.4 kJ per hour, which is less than the energy required to boil a pot of water, is needed to power the reactions.

Conclusions

According to the research, the engineering team has developed a system that can capture carbon dioxide 100 times faster than other modern technologies. Artificial leaves have great potential in renewable energy and electronics, as they can provide electrical energy for various devices without using fuel or other harmful sources of energy. The developed system allows for capturing carbon dioxide and using it to produce synthetic fuel. With the help of an electrically charged membrane, the process of capturing carbon dioxide is accelerated, and according to the team, their research results exceed existing analogs by more than 100 times. Additionally, only a small amount of energy, less than what is required to boil a pot of water, is needed to power the reactions.

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