

PEROVSKITE SOLAR CELLS: MARKET PROSPECTS AND COMPETITION WITH SILICON TECHNOLOGIES

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Анотація

В статті розглядається компанія Canon яка запропонувала захисне покриття для перовскітних сонячних батарей, які складуть конкуренцію кремнієвим фотоелементам.

Ключові слова: Canon, напівпровідник, перовскітні панелі, сонячні елементи.

Abstract

The article discusses Canon, which has proposed a protective coating for perovskite solar cells that will compete with silicon photovoltaic cells.

Keywords: Canon, semiconductor, perovskite panels, solar cells.

Introduction

Perovskite is a type of material with a special crystal structure used to make highly efficient solar cells. Perovskites were discovered over 100 years ago, but their potential in solar energy has only become apparent in recent decades.

The prototype perovskite mineral, calcium titanium oxide (CaTiO_3), has a distinctive crystal structure. Perovskite has a three-part structure, and its components have come to be referred to as A, B, and X.

Application

The perovskite family consists of many possible combinations of elements and molecules that can occupy each of the three components and form a structure similar to the original perovskite itself. (Some researchers have even bent the rules a bit by naming other crystal structures with similar elements “perovskites,” which is frowned upon by crystallographers.)

The crystals are characterized by their ability to efficiently convert sunlight into electricity, making them an ideal material for solar panels. Advantages of perovskite solar cells High conversion efficiency: perovskite solar cells have the highest conversion efficiency of all available technologies for converting solar energy into electricity. Low production costs: perovskite solar cells are cheaper to produce than conventional silicon solar cells due to cheaper raw materials and simpler manufacturing processes.

The unique properties of the material make solar panels flexible and lightweight. This opens up a wide range of applications, including integration into clothing, portable devices, and non-standard surfaces.

Canon has proposed a protective film for perovskite solar cells to compete with silicon solar cells.

Japan is focusing on producing perovskite panels, and Canon has a technology that could double their lifespan, according to Ecoticias magazine’s report on how it works.

Canon’s new material is a semiconductor that protects the perovskite layer. The Japanese company has promised to double the lifespan of its next-generation solar panels to compete with China. The material is used to protect damaged layers when exposed to moisture and heat, thereby extending the life of perovskite batteries by 20-30 years.

The thickness of the protective layer is 100-200 nanometres. Despite such a minuscule thickness, the material helps to reduce the cost of maintaining solar panels, which leads to lower costs and increased safety when using perovskite panels. This will not affect the efficiency of the solar cells, as Canon has made sure that the new material has semiconductor properties.

Canon plans to provide samples of the protective film to perovskite panel manufacturers this year, and mass production is scheduled for 2025. The production capacity of perovskite solar cells is expected to reach 38.3 million kW in 2024 and 84.2 million kW in 2050, exceeding the current production capacity of conventional solar panels of 70 million kW.

Earlier it was reported that these new solar cells will produce 1,000 times more energy. The new type of solar panel consists of 500 layers of barium titanate, strontium titanate and calcium titanate, 200 nanometres thick. The report also says that scientists know how to generate enough solar energy to power half the world. If 52.3 billion solar panels were installed along the world's highways, they could provide 60% of the world's annual electricity consumption.

Conclusion

To summarize it all, perovskite solar cells are a revolutionary technology in the solar energy industry. They combine high solar energy conversion efficiency with low production costs and flexibility of application. Innovative developments, such as Canon's protective film, significantly extend the service life of these cells, making them competitive in the market. Japan is actively developing this technology, and it is expected that the production of perovskite solar panels will increase significantly, which could lead to significant changes in the global energy sector.

REFERENCES

1. Refagi I. Japan 'destroys' solar panels and introduces a new invention that will last 30 years. August, 14, 2024. URL: <https://surl.li/cc/oxcrqg>.
2. David L. Chandler. Explained: Why perovskites could take solar cells to new heights. July 15, 2022. URL: <https://news.mit.edu/2022/perovskites-solar-cells-explained-0715>.
3. Ostymchuk G. Perovskites - the future of solar energy. March, 31, 2024. URL: <https://urlc.net/W0tF>.
4. Gnatyuk D. O., Nykyporets S. S. Use of photovoltaic power plants in the kherson region. Матеріали ЛІІ науково-технічної конференції підрозділів ВНТУ, Вінниця, 21-23 червня 2023 р. Режим доступу: <https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp-2023/paper/view/17850>.
5. Vasyliuk D. O., Nykyporets S. S. Principles of operation and structure of solar panels. Матеріали ЛІІ науково-технічної конференції підрозділів ВНТУ, Вінниця, 21-23 червня 2023 р. Режим доступу: <https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp-2023/paper/view/18446>.
6. Bondarets V. V., Nykyporets S. S. Solar cells: advantages and disadvantages. Матеріали ЛІІ науково-технічної конференції підрозділів ВНТУ, Вінниця, 21-23 червня 2023 р. Режим доступу: <https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp-2023/paper/view/18505>.
7. Lazyuk V. V., Nykyporets S. S. Solar panel landfills – our future? Матеріали ЛІІ науково-технічної конференції підрозділів ВНТУ, Вінниця, 21-23 червня 2023 р. Режим доступу: <https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp-2023/paper/view/18508>.

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