

# Solar Panels Based on a Flexible Material the Quad-Rotor UAV System

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**Abstract:** In view of the current practical application of solar UAV, insufficient endurance, poor stability, poor practicality and low solar energy utilization. We have designed a new four-rotor drone aircraft with solar energy and flexible materials (such as perovskite) as solar panels.

**Keywords:** Flexible Materials; Light Cell; Cruising Ability; Capacity Usage Ratio

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## 1. Research background

UAV technology has developed greatly in the past few decades, especially in the civil and commercial fields, with a blowout development in just a decade. The application of UAV is no longer limited to military use, but the application scope has been expanded to all walks of life in the society, including aerial survey and aerial photography, electric power inspection, plant protection, environmental monitoring, traffic accident handling, crime monitoring, fire monitoring, post-disaster rescue, oil and gas pipeline inspection, border patrol, drug planting supervision and other aspects. The advantages of low cost, good mobility, low risk coefficient and high efficiency make the UAV begin to gradually replace the traditional artificial way.

## 2. Research status of solar UAV at home and abroad

Foreign solar drones because of its early development, cycle is long, especially some western developed countries, under the background of the military application, invest a lot of money and energy, has extremely rich theoretical basis and design experience, coupled with continuous test, optimization, improvement, the United States and other countries have a very strong strength, in the conversion efficiency of solar panels, permanent magnet brushless motor, composite material has considerable advantages. Its products are serialization, systematic, integrated development. Up to now, the United States and the United Kingdom are still in the first echelon of the development of solar drones.

For solar UAV, although China's development time is short, but under the attention of the country, the same fruitful, has occupied a place in the solar UAV market. Published in 2015, Mozi was jointly developed by a Shanghai company and Tongji University, with a wingspan of 14 m, about 10 2 solar panels and a payload of 7 kg, making its first flight in 2016. The high-altitude long-endurance solar UAV rainbow independently developed by the 11th Research Institute of China Aerospace Science and Technology Corporation completed a near-space flight test in 2017, making China the third country to master this technology after the United States and the UK.

## 3. Introduction to UAV system

### 3.1 Invention purpose

In line with the design concept of "energy conservation and emission reduction, economic and efficient", design the use of perovskite solar panels miniature four axis drones, using solar energy supply, with fiber top as a balance device, provide better energy efficiency, improve the efficiency of the battery, improve the life of the drone, but also achieved the effect of energy conservation and emission reduction.

## 3.2 Power supply system

### 3.2.1 Photovoltaic power generation

Solar energy reserves, clean, environmentally friendly and sustainable, is considered to be one of the main energy sources replacing fossil fuels in the future. Photovoltaic power generation technology converts solar energy into electricity based on the photovoltaic effect, and the photovoltaic conversion efficiency has improved significantly over the past decade. In 1958, the first n/p-type monocrystalline silicon solar photovoltaic cell was developed in the United States and used for satellite power supply. The sun shines on the semiconductor p-n junction, forming new hole-electron pairs. Under the action of p-n junction electric field, optical holes from n region to p region, optical electrons from p region to n region, and the current is formed after the circuit is connected. This is how photoelectric effect solar cells work.

### 3.2.2 Flexible solar cells

With the rapid development of photovoltaic application scenarios and requirements in recent years, solar cell technology tends to be thin-film and flexible. Flexible solar cells are light, flexible, easy to carry and transport.

Flexible silicon cells prepare complex, high cost and serious efficiency loss; thin film cells such as copper indium gallium selenium have high photoelectric conversion efficiency, but low bending degree and high cost; organic solar cells can achieve high flexibility, but the cost and performance still need to be further optimized. Organic-inorganic hybrid perovskite solar cells are a new generation of photovoltaic technology, developing very rapidly, and its energy conversion efficiency is close to monocrystalline silicon cells.

The wing of the UAV uses perovskite solar plate, which has low price, high photoelectric conversion efficiency and better increase the endurance time.

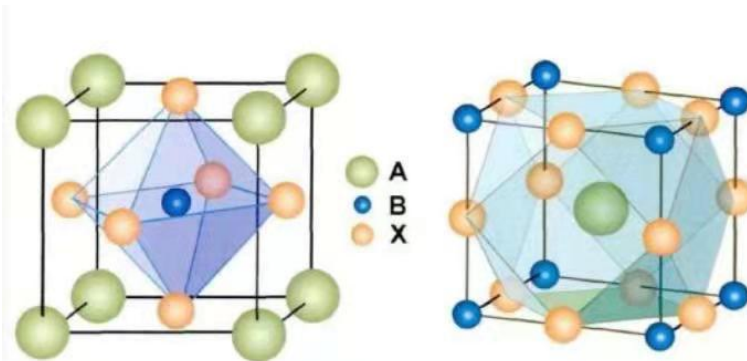


Figure 3.2.2-1, the molecular structure of the perovskite mine

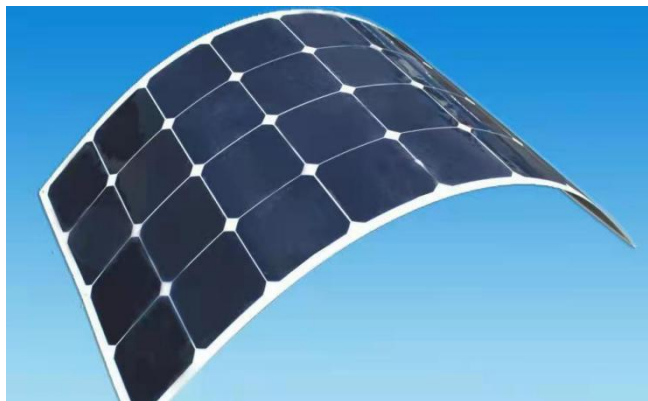


Figure 3.2.2-2 Flexible Solar Panel

## 4. Innovation characteristics and feasibility analysis

### 4.1 Innovation characteristics

Using solar energy to power drones to reduce environmental pollution to a certain extent. With the continuous growth of population, energy has become a problem that cannot be ignored. The study of renewable resources is of great significance for the future survival and development of human beings. Traditional batteries are harmful to soil, water and human beings. In line with the principle of low carbon economy, solar energy is inexhaustible and economic and environmentally friendly.

The endurance of UAV is not strong, and the execution of tasks in the air is limited. Solar flexible cells are used to improve the utilization rate of solar energy to increase the endurance time and improve the ability of UAV to work at high altitude.

In the power supply system, the material of the battery is optimized, using solar flexible cells. Compared with traditional rigid solar cells such as crystal silicon, flexible solar cells have the outstanding advantages such as good flexibility, low temperature preparation, low cost and easy to carry. The traditional crystalline silicon solar cell specific power is 40100W / Kg, the amorphous silicon thin film cell prepared on stainless steel substrate and polyester film substrate, light, soft and has high specific power. The specific power on stainless steel substrate can reach 1000W / Kg and 2000W / Kg, which provides power supply for the aircraft.

### 4.2 Feasibility analysis

Compared with the traditional photovoltaic UAV, the four-rotor flexible material photobattery UAV has higher light energy utilization rate and higher energy conversion efficiency, so that the flexible solar battery greatly improves the durability, the output current is more stable, longer duration, greatly improve the endurance time. Both civilian and military endurance is a current problem in the drone space. After the endurance is improved, the civil UAV aerial photography, mapping, drone pesticide spraying, which greatly reduce the time cost for businesses and users. In military, drones can be used as target aircraft, in military exercises, drones can be controlled through remote ground stations, field tracking, used as electronic spies, and can also transport supplies as cameras on the battlefield. It will make military operations and military exercises more efficient and more efficient after the endurance time is improved.

## 5. Model display

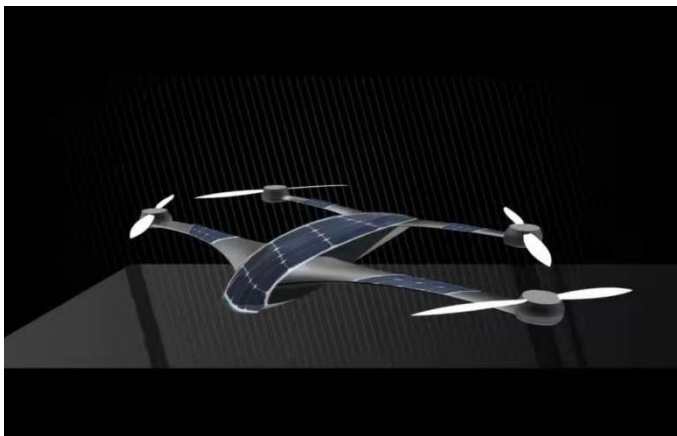


Figure 5 Illustraton of model

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