Recyclable Organic Solar Cells On Substrates Comprising Cellulose Nanocrystals (CNC)

The process of harvesting solar energy can limit its efficiencies

Sunlight is one of the most abundant natural and renewable sources of energy available; however, the way we produce the technology to harvest it can be expensive and damaging to the environment. Traditional silicon-based solar cells are expensive to produce due to the extensive process required to refine and process the material. This process in itself is not environmentally friendly, as it requires a significant amount of energy and resources. Additionally, once the material is configured into panels, they are rigid, limiting their ability to be integrated into a variety of structures. The panels are also fragile and brittle, which impacts their handling, transportation, deployment and installation, durability, and longevity. Furthermore, their recycling and disposing at the end-of-life cycle can be expensive and environmentally harmful.

Innovation reduces environmental impacts, costs, and compatibility issues

Researchers at the Georgia Institute of Technology employed cellulose nanomaterials to develop novel photovoltaic devices that are an alternative to existing technologies. This technology will reduce environmental impact, provide a sustainable solution for energy production, and solve the challenge of integrating solar cells into various applications due to the flexibility, low cost, abundance, and light weight of CNC substrates.

Summary Bullets

- The novel invention utilizes cellulose nanocrystals to create efficient organic solar cells with substrates that are renewable and exhibit strong mechanical and optical properties, achieving a high power conversion efficiency.
- The solution offers an environmentally friendly alternative to traditional silicon-based solar panels by being flexible, low-cost, biodegradable, and easily recyclable at room temperature.
- The innovation is suitable for commercial uses in low-cost electronics, biodegradable printed electronics, wearables, IoT applications, and sustainable building designs.

Solution Advantages

- Solar cells are recyclable through a low-energy, room temperature process.
- CNC substrates are made from renewable sources are abundant, low-cost, and fully biodegradable.
- Exhibit ideal optical properties with high transparency and low roughness.
- Demonstrate superior mechanical properties, enhancing durability and performance.
- Compatible with existing organic semiconductor processing techniques, allowing for up to 350°C processing temperatures.

Potential Commercial Applications

- Low-cost, lightweight, and flexible power supplies for consumer electronics and home appliances.
- Short-lived, disposable, or biodegradable power sources for low-cost printed electronics and architecture.
- Renewable energy solutions for wearables and Internet of Things (IoT) sensor applications.
- Applications in conjunction with textiles and garments, wearable electronics.
- Building-Integrated Photovoltaics (BIPV) for sustainable construction and design.

Inventors

- Dr. Bernard Kippelen
  Professor - Georgia Tech School of Electrical and Computer Engineering ; Director, Center for Organic Photonics and Electronics
- Yinhua Zhou
  Postdoctoral fellow — Georgia Tech School of Electrical and Computer Engineering
- Canek Fuentes-Hernandez
  Research Scientist II — Georgia Tech School of Electrical and Computer Engineering
- Jeffrey Youngblood
- Dr. Robert Moon
  Adjunct Professor - Georgia Tech School of Materials Science and Engineering

IP Status

Patent has issued : US9203030B2

Publications

Recyclable organic solar cells on cellulose nanocrystal substrates, Nature, Scientific Reports - 2013

Images

Visit the Technology here:
Recyclable Organic Solar Cells On Substrates Comprising Cellulose Nanocrystals (CNC)