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# A Mini Review of Flexible Polymer Solar Cell with Higher Conversion Efficiency

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**Abstract**

Polymer solar cells have shown good prospects for development due to their advantages of low cost, lightweight, solution-processable fabrication, and mechanical flexibility. Each polymer solar cell shows huge potential as a flexible and portable power generator. This device can offer good mechanical durability with high conversion efficiency which is applicable in appliances. Scientists developed highly efficient and mechanically favorable polymeric solar cells based on the polymer donor and the polymer acceptor. Moreover, polymer solar cells can show drastically enhanced power and flexibility in comparison with polymer/Phenyl-C61-butyric acid methyl systems. This article reports a short review of recent development on flexible polymer solar cells which can easily bear more resistance and can be used as preferable for applications in flexible and portable appliances.

**Keywords:** Polymer; Silicon; Organic materials; Temperature; Fabrication

**Abbreviations:** PSCs: Polymer Solar Cells; PCE: Power Conversion Efficiency; ITO: Indium Tin Oxide; OLEDs: Organic Light-Emitting Diodes

## Introduction

Over the last decade, polymer solar cells have been the focus of a significant amount of research, which has led to significant advancements in cell performance. The conversion efficiency of traditional solar cells reaches beyond 30% in silicon solar cells [1-3]. Flexible Polymer Solar Cells (PSCs) with inverted construction are attracting extensive interest due to their promising Power Conversion Efficiency (PCE), mechanical flexibility, as well as compatibility with high-volume large area fabrication and roll-to-roll processing [1-3]. This is because flexible Polymer Solar Cells (PSCs) offer a promising alternative for low-cost renewable energy technology in wearable and portable equipment [3,4]. Flexible Polymer Solar Cells (PSCs) with inverted construction offer a promising alternative to silicon solar cells now have a Power Conversion Efficiency (PCE) that is higher than 10% for single-junction polymer solar cells, and the result is even higher for tandem and multi-junction devices [4-6]. Polymer solar cells are prepared using organic materials and these are part of flexible solar cells. These polymers are large stable structural modules, which generate electricity by harnessing sunlight through the photovoltaic effect.

## Types of Flexible Polymer Solar Cells

According to the cell type, different kinds of polymer solar cells can be prepared. The most preferred forms are inverted and bulk heterojunction polymer solar cells. In bulk polymer heterojunction solar cells, the combination of organic semiconductor materials from the donor and acceptor is generated as a fine layer. The donor atoms have electrons in excess in their valence shell to donate them to other atoms that are deficient in them. The efficiency of this type of solar cell increases due to exciton formation by the two separate charge carriers which greatly improves the area. In some cases, the efficiency is up to 10% [7]. The inverted polymer solar cells are also one of the most preferable cells. The shift in the electrode's location is sufficient to create an inverted cell in a regular bulk heterojunction or bilayer solar cell [7,8]. Acceptor molecules like fullerene derivatives are quite susceptible to moisture and oxygen

and thus are preserved in the translucent conducting layers of the solar cell. Translucent conducting layers are used as substratum and are typically compassed on polyethylene terephthalate or glass in the commercial solar cell market.

## Recent Innovations in Flexible Polymer Solar Cells

In recent times some ideas for harnessing solar power:

a. Transparent solar panels make any object an energy collector.

b. Spacecraft use solar power to orbit the planet.

c. Solar panels with style move into the living room

d. A photovoltaic storage system for portable solar power.

e. Lightweight, flexible solar panels designed for indoor uses.

## Advantages and Disadvantages

Polymer solar cells provide several benefits that are inherent to their use. The mechanical flexibility of the material is the most important specialty because it makes it easier to coat onto flexible substrates. As a consequence of this, the researchers attempted to fabricate devices on flexible substrates. A report demonstrates polymer solar cells on flexible Indium Tin Oxide (ITO)-coated polyester foils with the Photon Conversion Efficiency (PCE) 3%, which is comparable to the cells that are on an Indium Tin Oxide (ITO)-coated glass substrate [9,10]. The use of such flexible substrates does, however, present some technological challenges. This is due to the fact that plastics experience thermal shrinkage when Indium Tin Oxide (ITO) is deposited on them. Researchers were looking for some anode materials that could replace ITO so that they could create fully flexible polymer solar cells. Additionally, they wanted to eliminate the need for indium tin oxide. In Organic Light-Emitting Diodes (OLEDs), a highly conductive poly3,4-ethylene-dioxythiophene: polystyrene sulfonate Baytron PH500 was recently used as a polymer anode to replace indium tin oxide. organic light-emitting diodes with a PH500 anode had efficiencies that were comparable to, and in some cases even surpassed, the efficiencies that were achieved from indium tin oxide-based devices [10-13]. Researchers have just very recently revealed efficient polymer solar cells by stacking two different doped forms of PH500 on top of each other as an anode on glass substrates and annealing them at a high temperature [9-12].

## Challenges

When it comes to actual work, the efficiency and consistency of the performance of solar cell technology become equally important considerations. Despite their consistent effectiveness, there is a reason to be concerned about their long-term stability [14,15]. The performance declines not only for intrinsic reasons like structural instability and interaction with selective transport layers, but also for extrinsic factors like moisture, temperature, ultraviolet radiation, hysteresis, and so on. Intrinsic reasons include things like these. The fact that it is more difficult to effectively cover flexible polymer solar cells makes them even more susceptible to the aforementioned factors.

## Conclusion

Polymer solar cells are desirable products to solve the cost problem of widely available Si-based cells due to their versatile and low-cost fabrication methods. As they are inexpensive, compact, and portable as well as solid-state devices, there is no requirement for water or electrolyte to ensure preparation. Furthermore, several researchers all around the world are in work to increase the efficiency and stability of flexible polymer solar cells.

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