International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

PLASTIC ELECTRONICS

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ABSTRACT :

Plastic electronics, also known as organic electronics, is a rapidly emerging field that utilizes plastic or organic materials to create flexible, lightweight, and sustainable electronic devices. This technology has the potential to transform the way we design, manufacture, and use electronic devices, enabling new applications and form factors that are not possible with traditional silicon-based electronics. Plastic electronics combines the benefits of plastics, such as flexibility, low cost, and ease of processing, with the functionality of electronics, such as conductivity, semiconductivity, and optical properties. This fusion enables the creation of flexible displays, wearable electronics, implantable devices, and conformable sensors that can be integrated into various surfaces, including textiles, papers, and even human skin.

Keywords:

1. Organic Electronics
2. Flexible Electronics
3. Printed Electronics
4. Wearable Electronics
5. Conformable Electronics
6. Stretchable Electronics
7. Transparent Electronics
8. Conducting Polymers
9. Organic Semiconductors
10. Polymer Electronics
11. Flexible Displays
12. Plastic Transistors
13. Organic Photovoltaics (OPV)
14. Organic Light-Emitting Diodes (OLED)
15. Bioelectronics
16. Implantable Devices
17. Smart Textiles
18. Flexible Circuits
19. Roll-to-Roll Processing
20. Solution Processing

INTRODUCTION :

Plastic electronics or organic electronics is a branch of electronics that deals with device made from organic polymer or conductive polymer. Plastics or small molecule, as opposed to Silicon. Organic electronic because the polymers and small molecules are carbon based, like the molecules of living things. This is as oppose to traditional electronics which relies on inorganic conductors such as silicon or copper. Conduction mechanisms involve resonance stabilization and delocalization of pi-electrons along entire polymers backbones as well as mobility gaps, tunneling and phonon-assisted hopping conductive polymers are lighter, more flexible and less expensive than inorganic conductors. This makes them a desirable alternative in many applications. It also creates the possibility of new applications that would be impossible using copper or silicon. New application includes small windows and electronic paper. Conductive polymers are expected to play an important role in the emerging science of molecular computing. In general, organic conductive polymers have a higher resistance hence therefore conduct electricity poorly and inefficiently, as compared to inorganic conductors. Researchers currently are exploring way of doping, organic semiconductors like melanin, with relatively small amount of conductive metals to boost conductivity. However, for many applications, inorganic conductors will remain the only viable option. In the last decade, a high number of technologies to realize conformable electronic systems have been developed by a number of research institutes [1-8]. A wide variety of different processes exists nowadays to realize such systems, where each technology has its own particular characteristics and targeted application fields. Each technology has its advantages and disadvantages in terms of processability, reliability, scalability and cost. Plastic electronic, organic electronics, polymer electronics is a branch of electronics that deals with conductive polymers, plastic or small molecules. Plastic electronic materials and high resolution printing methods may be important technologies for new classes The consumer electronic device that are lightweight, mechanically flexible and that can cover large area at low cost Plastic electronics based on semiconducting polymers is a very promising technology to enter the low cost low performance segment of the electronic market. Radio frequency identification systems like identity tags, electronic watermarks, smart cards, electronic labels can be produced in a large scale. Thin film transistors for active matrix displays seem possible as well.

Plastic Electronics allows circuits to be produced at relatively low cost by printing electronic materials onto any surface, whether rigid or flexible. it is very different from the assembly of conventional silicon- based electronics. it will lead to the creation of a whole new range of products such as conformable and rollable electronic displays, ultra-efficient lighting and low-cost, long-life solar cells.

LITERATURE SURVEY

A look at the research in the field of plastic electronics: "Polymer challenge". Authors: Ajay Oraon, A.G.P. Kujur, Rakesh.

Abstract: It was initially difficult to produce plastics which excelled in three attributes, namely translucence, malleability and conductivity. Materials matters a

lot when it comes to making plastic conductive. Polymer semiconductors are developed for their own specific application. Another advantage with plastic electronics lies with the sample manufacture process involved. Because of its thin size and ability to bend, it can be installed anywhere as window slides, over cars, on backpack etc. "Plastic electronics is complementary to silicon and is unlikely to replace silicon in applications which are suited to silicon, such as computation". The future should accommodate fast silicon electronics with cheaper plastic electronics.

Shape-Engineerable Silk Fibroin Papers for Ideal Substrate Alternatives of Plastic Electronics.

Authors: Haitao Liu, Wei Wei, Lei Zhang, Jianliang Xiao, Jing Pan, Qin Wu, Shuqi Ma, Hao Dong, Longteng Yu, Wenzhen Yang, Dacheng Wei, Hongwei Ouyang, Yunqi Liu

Abstract: Plastic-based electronics fill the gaps in conventional rigid silicon-based devices toward the applications in soft interfaces. However, people in the future should also consider their potential environmental impact if tons of non-degradable plastics are applied. Silk fibroin is a superior substrate alternative for the development of "green" electronics; whereas, the brittleness of silk films is still a major limitation impeding their practical use. Different from the widely reported polyphasic composite approaches, here a trace-ion-assisted plasticization strategy is developed, and shape-engineerable pure silk fibroin paper (PSFP) is prepared for the first time, which can be engraved and crumpled like a sheet of paper in the dry state. The PSFPs exhibit higher tensile fracture energy (14.4 ± 4 kJ m^{-2}) than any typical plastic-electronic-substrates as far as it is known.

Fully elastic interconnects on nanopatterned elastomeric substrateAuthors:: Mandlik P Lacour, Wangner S.

Abstract: In this contribution , results on technology developments are presented aiming to realize conformable electronic systems based on plastic electronics.

Focus of the developments is on low cost with an acceptable reliability in function of the end-application. The feasibility of this technology is demonstrated by digging into the different process steps and their characteristics.

WORKING PRINCIPLE

PRINCIPLE OF OPERATION

Organic semiconductors are promising active materials for next-generation thin-film electronics. The material's intrinsic softness, solution processability, and synthetic tunability are among the major advantages, because these traits make it possible to produce ultra-thin, light-weight, flexible, and multifunctional large-area systems in a cost-effective manner.

Charge carrier transport in polymeric and organic semiconductors, which is the process of transporting electrical charge across the material. Optical properties of organic semiconductors, which is the interaction between light and the material.

METHODOGOLIES

The plastic electronics involves various methodologies and techniques to encode, transmit, and decode audio signals using modulated light waves.

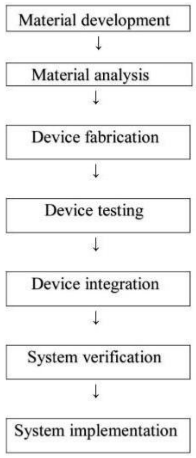

Fig 1: Methodology of Plastic Electronics

Material Synthesis: The first step is to synthesize the plastic materials used in plastic electronics, such as conjugated polymers or organic molecules. These materials are designed to have specific properties, such as conductivity or semiconductivity.

Material Characterization: The synthesized materials are then characterized to determine their properties, such as their electrical conductivity, optical properties, andthermal stability.

Device Fabrication: The characterized materials are then used to fabricate plastic electronic devices, such as transistors, diodes, or sensors. This can be done using various techniques, such as spin-coating, inkjet printing, or screen printing.

Device Characterization: The fabricated devices are then characterized to determine their performance, such as their current-voltage characteristics, mobility, and switching time.

Device Integration: The characterized devices are then integrated into more complex systems, such as flexible displays, wearable electronics, or implantable medical devices.

System Testing: The integrated systems are then tested to determine their overall performance, reliability, and stability. System Deployment: Implement the system in real-world applications.

TECHNOLOGYS

The different types of technology in plastic electronics include:

- Printable inks: Many materials used in plastic electronics are soluble and can be processed into printable inks, allowing for cheap and efficient manufacturing of electronic devices.
- IME technology: This technology is used to produce flexible sensors that can be integrated into the housing of devices, eliminating the need for mechanical push buttons.
- Thermoplastic techniques: These techniques allow for the creation of a variety of decorative and functional parts, including electronic boards, control panels, gauges, lights, and more.
- Organic materials: Organic materials, such as molecular solids, oligomers, and polymers, are used in plastic electronics due to their compatibility with high- throughput, low-cost processing techniques and their ability to be precisely functionalized through organic synthesis.
- Solution-processable property: This property allows organic materials to be used differently from inorganic materials, enabling printability and other unique manufacturing techniques.
- Flow-based methods: These methods are used for controllably synthesizing high-performance electronic materials in high volumes, and for designing, fabricating, and applying optoelectronic devices.
- Injection molding: This technology is used to produce components with plastics.
- Compression molding: This technology is also used to produce components with plastics.
- Encapsulation: This technology is used to produce components with plastics.
- Microchip technology: This technology is used to make electronic devices smaller, more effective and more reliable.
- Conjugated polymers technology: This technology is used to produce plastics that can conduct electricity like a metal material.
- Plastronics: This technology is used to produce lightweight and highly flexible devices.

ADVANTAGES

- Flexibility and Conformability
- Low Cost
- Lightweight
- High Performance
- Biocompatibility and Biodegradability
- Easy to Manufacture and Integrate
- Scalability
- Low Power Consumption
- Shock and Vibration Resistance
- Customizable

APPLICATIONS

- Cable and wiring insulations.
- Circuit boards.
- Conduits.
- Poly LED.
- Plastic transistors .
- Plastic lasers.
- Plastic solar cells.

CONCLUSION

The conclusion of plastic electronics highlights the potential of this technology to revolutionize the field of electronics by providing a flexible, lightweight, and cost- effective alternative to traditional electronics. The use of plastic substrates and organic materials has enabled the development of a wide range of innovative devices, including flexible displays, wearable electronics, and implantable medical devices. This technology has opened up new possibilities for device design, enabling the creation of flexible, conformable, and even stretchable electronics that can be integrated into a variety of applications The advantages of plastic electronics are numerous, including their flexibility and conformability, low cost and lightweight, high performance and efficiency, biocompatibility and biodegradability, and ease of manufacture and integration. These benefits have led to the development of a wide range of applications, including wearable technology and lOT devices, flexible and foldable displays, implantable medical devices and sensors, energy harvesting and storage devices, and smart packaging and labeling.

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