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Review Article

Polymer Electronic System

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Introduction

Main Polymers molecules formed of many identical units, bond to each other into long chains. For a polymer to be electrically conductive it must imitate a metal – the electrons in the bonds must be freely mobile and not bound fast to the atoms. In 2000 Alan Heeger, Alan MacDiarmid and Hideki Shirakawa were awarded the Nobel Prize in Chemistry for showing how polymer can be made to conduct electric current. One condition for this is that the polymer should consist of alternate single and double bonds, termed conjugated double bonds. At present, the electronic world is very much dominated by inorganic materials, in particular silicon. The Nobel Prize hasn't been a milestone in the progress of polymer electronics, but it showed the importance of this branch of knowledge. New word, "polymer" has appeared in electronic vocabulary as a short name of this knowledge and quickly developed technology.

State of the art

The history of polymer electronics started more than 25 years ago – firstly conductors, than semiconductors, transistors and fully functional polymer ICs. But the mobility of charge carriers in polymers is limited and incomparable to silicon. Nevertheless in the last 10 years many properties of material were improved. For example, field effect mobility could be increased from below 10-3 cm2/Vs to higher than 1 cm2/Vs both for vapours-deposition materials and for polymers and solutions which can be spin-coated. For spin-coated organic-inorganic hybrid materials up to 50 cm2/Vs can be measured at room temperature. However, all mentioned values are only achieved for p-type materials so that the realization corresponding n-channel-transistors (and therefore of a complementary logic or a bipolar technology) still needs intensive research. Simple polymer transistors were reported at the beginning of nineties. In 2001 a report was published that the Polymer Electronics.

Needs of polymer electronics

The present technology development of polymers active devices is comparable with that at the beginning of the silicon-based IC industry, some 30 years ago, but with the technology possibilities of today. In quest of cheap polytronics, researchers over the last five years have progressed from making fairly rudimentary single all-polymer transistors, to expect integrated circuits made all, or nearly all, from plastics in the future. The use of polymer electronics is opening up an exceptionally large market and is made possible by the low cost of plastic ICs. It is expected that, once the development of the production process is completed, the plastic chips can be produced at a cost price of the order of Cents per finished chip.

The offer of polymer electronics

The role of polymer electronics is not primarily a replacement for existing silicon devices, but opens up the prospect for completely new applications that combine the features of transistor, LED, detector and interconnect devices with the freedom of design, flexibility and low cost of plastics. In view of these new findings it seems possible that polymers may solve present and coming problems and add new functionality to microelectronic circuits and systems. Polytronics creates anew and very promising technological area with new applications and products. Examples are:

- Full polymer transponders (RFID).
- Printable tags.
- Flexible systems.
- Disposable electronics.
- Body area networks, smart clothing wearable computing.
- Pervasive computing and communication systems.
- Electronic circuits for "polymer based" photovoltaic, detectors, imaging applications, displays, illumination systems.
- Disposable and low cost sensors (biochemical).
- Actuators.
- Disposable low cost memories (bistable).

The practical use in every day's life of polytronic products offers advantages from the environmental point of view. Products based on polytronics can be manufactured with relative simple and inexpensive equipment at low cost. Other important advantages are related to the unique mechanical properties of polymers: they are light weighted and flexible, very durable and rugged under stress and flex, and can be easily applied and maintained over a large surface area. The manufacturing of polytronic-based electronic products does not have to be done in large, ultra pure, energy-devouring clean rooms. The polymer materials are used selectively where they are needed (printing) and are not wasted. The organic material can be effectively dealt with after use and in recycling. No high temperatures need to be applied in the processing of organic materials. Not only the manufacturing possibilities but also the materials used are very promising from the environmental point of view compared to the materials used in today's electronic products: Polytronics seems to be great hope for future mobile products, the mass market of the future, because their environmental performance can be improved to a great deal by means of engineering, in contrast to the toxic properties of, for instance, many metals.

Application on polymer electronic system:

1. Cell phones.
2. OFET.
3. OLEDS.
4. Plastic batteries.
5. Organic cell solar.

Organizing of seminar report

Chapter 1: includes introduction of polymer electronic system. Chapter 2: includes description on polymer electronics. Chapter 3: implementation of polymer electronic system. Chapter 4: includes results and discussion. Chapter 5: include future scope and conclusion.

Description on Polymer Electronics

Polymer Electronics

Plastic electronics, Organic electronics, or polymer electronics, is a branch of electronics that deals with conductive polymers, plastics, or small molecules. It is called 'organic' electronics because the polymers and small molecules are carbon-based, like the molecules of living things. This is as opposed to traditional electronics (or metal electronics) which relies on inorganic conductors such as copper or silicon 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 roll able electronic displays, ultra-efficient lighting and low-cost, long-life solar cells. its market value is forecast to rise from $2 billion today to $120 billion in 2020.Plastic electronic materials and high-resolution printing methods may be important technologies for new classes of consumer electronic devices that are lightweight, mechanically flexible and bendable, and that can cover large areas at low cost. This area will be important (at least initially) not because of its potential for achieving high speed, density, and so forth but because the circuits can be rugged and bendable, and they can be printed rapidly over large areas at low cost. These features can be difficult to achieve with the brittle inorganic materials and sophisticated processing techniques that are used for conventional electronics. Bendable plastic circuits will enable new devices—electronic paper, wearable computers or sensors, disposable wireless identification tags, and so forth—that complement the types of systems that existing silicon-based electronics supports well.

Modern way of polymer electronics

The modern day electronics industry has been largely influenced by silicon. The very fact that silicon is widely available makes it an integral part of semiconductor chips however the Wide Spread use of silicon in electronic goods has a large number of disadvantages some of which are listed below:

1. Production of silicon embedded circuits involves a huge investment.
2. These circuits also consume more power easily portable.

So, many organizations and institutes are on the lookout for alternatives, which can effectively replace the uses of silicon and thus eliminate the above disadvantages. This paper looks into one such alternative, an all new exciting and emerging field called polytronics this field essentially deals with the use of plastics or conjugated polymers as electricity conducting materials. Hence the name 'Polymer electronics or Polytronic Through this paper we have established our views on how polytronics could help in reducing the problems associated with the present day electronics. Also in this paper we have discussed about the additional benefits that this technology can provide.

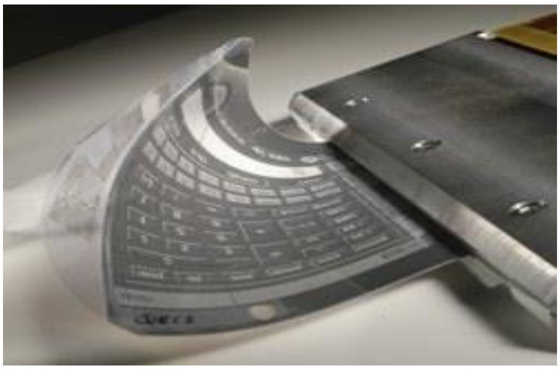
New trends in polymer electronics

In this section we look into some of the areas in which polytronics is making a huge impact.

Printing of circuits

Fabrication of microelectronic components would allows manufacture of complete gadgets through just printing process in the near future. Such a technology is being developed by the University of California. The technology would focus on building any electronic device from bottom up gradually, so, instead of building a device by adding new components through the regular "assemble and build" technique, the entire product would come out of the printer complete with electronic circuitry embedded in the product itself.

Figure (1): Printing of Circuits



The structural, mechanical and electronic elements would be indicated using 3D printing techniques, in three simple steps using a CAD software tool think of a design, take the necessary ingredients and insert them inside the printer and finally print. Technologists point out that for the process to succeed in major applications two main criteria have to be fulfilled: "Basically, the material viscosity must be low enough to allow controlled ejection from the inkjet during fabrication. Secondly, the material must remain a liquid for a sufficient time before jetting so as to not clog the printing orifice, yet solidify within a Reasonable time after jetting". With these two things in place it would be possible to print almost anything from a combination of polymer and oligomer solutions, polymer resins, molten solders and nano-particle suspensions.

Rubber electronics

Researchers at the 'John Hopkins University' have successfully built rubber circuits out of an several squashed but extendable gold wires. The circuits are about 20 times thinner than a human hair and have the potential to be stretched by over half their initial length without loss of electrical conductivity. Stretched gold wires are manufactured by electroplating gold onto a sheet of silver, later on the silver is stripped and the wires are encased inside the polymer. The rubbery circuits would be woven into clothes to monitor the heartbeat of sports persons or for better functions. As artificial nerves that can bend inside the body such flexible circuits would be less painful to embed in the brains of persons suffering from Parkinson's disease.

Polytronics and the environment

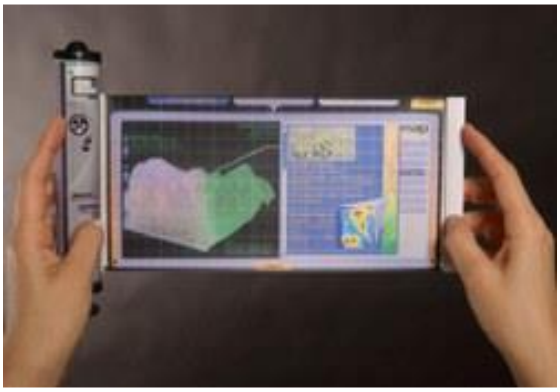
Polytronics not only addresses issues related to the electronics industry, also it helps us in addressing environmental issues and paves the way for the formation of an eco-friendly environment.

Electronic paper

The paper and pulp industry which produces huge amounts of inorganic pollutants such as sulphides, bleaching liquors and organic pollutants like cellulose fibers, bark, wood, sugars, organic acids etc which leads to various forms of pollution. The axing of trees for the purpose of use in such industry leads to deforestation, which in turn leads soil erosion and other, related problems.

One way to overcome this problem of resource consumption and pollution due to extensive use of paper is to have a single sheet that can be updated regularly. This is precisely what e-paper is all about.

Figure (2): Electronic paper



An E-paper can be continuously updated via the Internet and even used as an innovative display that can be rolled up tightly without any damage. These display devices are produced using direct inkjet printing technology as it is quite economical and the circuit is a part of the whole display package itself. The display typically uses E-ink, which is activated by electric charge to update the content.

Researchers at Philips semi-conductors are working on a prototype whose circuitry is made from a semi-conducting organic material called 'pentacene'. They laid thin films of pentacene on a flexible plastic by simply spreading a solution of the organic material over the plastic substrate. Since the circuit is a part of the display itself, it is economical to produce. Research is also in progress to create full color display, which would be four times brighter than the devices made from liquid crystals. A prototype is being developed in which the researchers have made use of a single sheet covered with electronic ink that looks like ordinary paper. The information is stored in a portable chip, and a slim line lightweight battery powers the display. The ink would rearrange electronically fast enough to show even video movies.

Plastic batteries

Batteries are indispensable sources of power in our day-to-day life. However with their widespread use and the ineffective ways in which they are disposed has led to serious environmental problems. To tackle this problem, researchers have developed all plastic batteries in which both of the electrodes and the electrolytes are made of polymers. The positive and negative electrodes are made of thin, foil-like plastic sheets. Electrolyte is a polymer gel film placed between the electrodes holding the battery together. These batteries are lightweight and can be molded into any size and shape for use in satellites and important military equipment. Scientists are planning practical applications of plastic batteries by linking them with solar cell charging system to power space satellites when they are in orbit. Tests at the Hopkins's lab have yielded positive results. Polymer batteries can be recharged and reused a number of times without loss of power. Besides these don't contain hazardous chemicals typically found in nickel-cadmium cells and are therefore environmentally safe.

Innovative display of options

We expect our displays to produce crystal clear images, but what if they could be erased and updated for use over and over again and most importantly rolled up to fit in your pockets? It may seem impossible, but such are the possibilities that polytronics can offer. These types of display units basically make use of OLED's or organic light emitting diodes. These can be made on almost any flexible or stiff substrate. Basically they are emissive displays, i.e., they create light and don't need a separate backlight to provide light for the image. This technology can be used in new generation of digital cameras, mobile phones and PDA's. Even clothes with moving pictures are possible. Moreover these display units have other inherent advantages as well: Firstly they are thin, light weight and also allow wider viewing angle. Secondly they can be read in bright sunlight unlike the present display units. Thirdly and most importantly they help in reducing environmental pollution caused due to electronic wastes.

Electronic wastes

Any waste that has a circuit board or CRT is called an E-waste. Environmentalists and officials say the waste contains more than 1000 different toxic substances harmful to human beings and the environment. "If we do not wake up now, in the next five years it will boomerang on us," said Bakul Rao, a consultant with the Environment Management and Policy Research Institute, a research body set up by Karnataka state's Pollution Control Board. As IT firms continue to swamp India's technology hub of Bangalore, the city is starting to choke under a heap of e-waste generated from obsolete computers and discarded electronic components.

Figure (3): Electronics wastes

The Environment Management and Policy Research Institute says that next year about 1000 tones of plastics, the same equivalent of iron, 300 tons of lead, 0.23 tones of mercury and 43 tons of nickel and 350 tons of copper will be generated as e-waste in Bangalore. "This figure will increase by ten-fold in 2020 when Bangalore will generate one-third of the state's e-waste," Rao said. "The findings are quite alarming as there are no regulations and no scientific disposal systems."

Bangalore has more than 500 recyclers of discarded computers and electronic components. They sell second-hand parts either to computer assemblers in the grey market or to buyers directly at the weekly Sunday bazaar. "There is no scientific recycling happening anywhere in

Bangalore. Most of the e-waste including lead and plastic is dumped along with the municipal waste and then burned," Rao said."Bangalore has more than 100 illegal dump pits for e-waste," she said. The burning of printed circuit boards at a low temperature leads to the release of extremely toxic components which can cause cancer, a report by the institute said. Barium found in e-waste, it added, could damage the heart and liver while other chemicals such as beryllium found in computer motherboards and cadmium in chip resistors and semiconductors are poisonous and could lead to cancer. Chromium in floppy disks, lead in batteries and computer monitors, and mercury in alkaline batteries and fluorescent lamps also pose severe health risks. Other substances such as copper, silver and tin could also be damaging, the report said. Therefore there is an urgent need to do something about this problem and Polytronics could well be the solution for the same.

Plastic recycling

Since it has been noticed that plastic is also being considered as an important part of electronic waste, effective recycling of plastic is the main issue, which limits the use of Polytronics in mainstream electronics. The American plastics council has been announcing the safe recovery of plastic from electronic equipment. MBA Polymers, Richmond, CA, includes an "advanced plastics recycling line" that is developing and demonstrating new technologies for durables recycling. These include technology for plastics identification and sorting, and improving the quality and reducing the costs of recovering plastics from durable goods. Currently, APC (American plastics council) and others are conducting research to evaluate recovery of telephones, automotive parts, computer housings, refrigerator doors and cabinet liners. Through such organizations, the plastics industry is developing technologies to collect, sort and reclaim plastics more economically, broadening its focus to include durable products and commercial streams, researching new applications and end-markets for recycled plastics, and promoting existing markets through publications such as "The Recycled Plastic Products Source Book" and "Shop Recycled!" The American Plastics Council offers the following services and resources:

Toll-Free Information Line: Community officials and recyclers can get the technical information they need by calling 1-800-2-HELP-90. Information Specialists can access APC's databases listing more than 1,700 plastics handlers and reclaimers to match supply with demand for post-consumer plastics.

Technical Research Programs: The state of the art in plastics recycling is constantly evolving. APC works to hasten this evolution, pursuing a wide range of technical solutions that Can add greater automation and operating efficiency to each step of the plastics recycling infrastructure, from collection to end-markets. The findings from these research programs have resulted in a series of technical manuals to help advance plastics recycling across the country.

Moreover since the display units that polytronics offers is completely made of different types of conjugated polymers, only plastics recycling has to be addressed unlike in the case of present day display units wherein you have a whole range of toxic and hazardous substances to consider

Conclusion on plastic recycling

In this paper we have explained in detail some of the recent breakthroughs in the field of polytronics. When implemented properly, polytronics can bring about a revolution in the life of common man. We would like to conclude the paper by highlighting the importance of polytronics. In fact the question to be answered at this stage is “Why Polytronics?” Apart from the exciting features that we have discussed so far such as printing of circuits, electronic paper, led’s, rubber electronics etc… Polytronics has a major role to play in protecting our environment. With efficient use and reuse of such products we can go a step ahead in the issue of electronic waste. Apart from safe guarding the environment in which we live, use of plastics in the manufacture of electronic products bring down the cost involved in production, thereby safeguarding the Interest of the economy as well. The aim of Polytronics is to build products that can reach the substratum of the society, to build a better society in which each and every individual has access to the features that it has to offer. Through this paper we would again like to emphasize the fact that Polytronics is the next BIG THING. In short it is a field that offers tremendous opportunities for young and budding engineers, field that is going to revolutionize the way in which we live. Safeguarding the interest of the economy as well the aim of Polytronics is to build products that can reach the substratum of the society, to build a better society in which each and every individual has access to the features that it has to offer. Through this paper we would again like to emphasize the fact that Polytronics is the next BIG THING. In short it is a field that offers tremendous opportunities for young and budding engineers, field that is going to revolutionize the way in which we live.

Principals of polymer

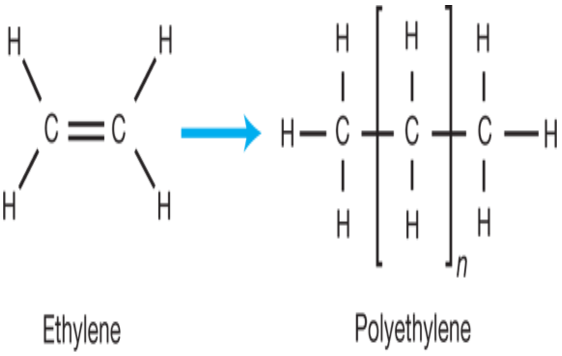
Principles Polymer electronics is an emerging technology that focuses on the development of electronic devices incorporating electrically conductive and semi conductive organic materials, especially organic polymers. It offers the prospect of an advanced electronics platform using new materials, processes and electronic devices. Polymer conductors and semiconductors open up prospects for microelectronic systems that go beyond the scope of conventional electronics based on silicon as the semiconductor. 7 Properties of polymers. Plastic materials are organic polymers, which mean that they consist of large molecules with long repeating chains of smaller organic units. Depending on the structure of the materials, they are electrically insulating, conducting or semiconducting. The insulating properties of organic materials, especially polymers, have been used for a long time in electronic applications, for example as wire insulating coatings or as insulating housings. Special polymers, such as conductive polyacetylene, consist of many identical single units, or monomers, combined in a chain. Typically, these organic polymers are based on chains of carbon atoms combined with hydrogen atoms. Conjugated chains comprise alternating single and double bonds between the carbon atoms, which result in delocalized electron states; in this case the polymer is semi conductive. It should be mentioned that these properties are not limited to polymers, and smaller molecules like pentacene or benzene also exhibit this behavior. These semi conductive organic materials can be transformed within special devices like transistors to either a conductive. Are molding, blowing, calendaring, casting, extrusion, foaming, spinning of fibers, etc? Polymer waste is a serious burden for the environment because common organisms existing in nature are incapable of metabolizing them. Specialty polymers are materials having useful properties which cannot be found with any other material, produced in small quantities and applied in cases when the price is not too important. Main fields of application of those polymers are special electronics, space technology and medicine.

Principals of polymers

Macromolecules and polymer macromolecules

Macromolecules and Polymers Macromolecules, i.e., big molecules, are molecules with large or very large molecular mass. Molecules of common low-molecular-weight substances, such as water - H_2O, oxygen - O_2, carbon dioxide - CO_2, toluene - $C_6H_5CH_3$, etc., have relative molecular masses of the order of magnitude of tens or hundreds. Macromolecules have masses hundred up to million times larger. High molecular mass and corresponding structural complexity of macromolecules is the causes of their specific properties. For instance, a molecule of polyethylene, one of the most common synthetic plastics, a small section of which is described by the structure formula shown in Figure 1 comprises thousands up to hundreds of thousands of carbon atoms and its relative molecular mass can range from tens of thousands to millions.

Figure (3.1): Formula of Polyethylene



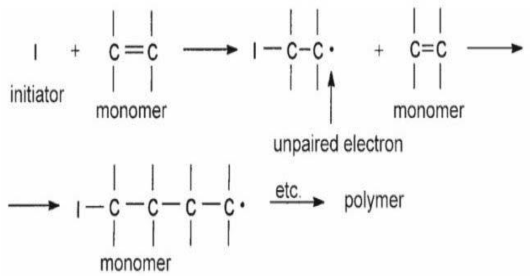
Formula of a small section of a molecule of polyethylene. A polymer is a material which is composed of macromolecules of the same kind. Thus, polyethylene consists of a large number of polyethylene molecules. A material is classified as a polymer if an addition or subtraction of a few basic structural units to or from its macromolecules, i.e., in the case of polyethylene of a few −CH2− units, does not change its properties perceivably. Substances composed of molecules containing a few up to tens of basic structural units, i.e., −CH2− groups in polyethylene, are called oligomers. Oligomers are a transition between low-molecular-weight substances and polymers. A change in the number of basic structural units in oligomer molecules results in an observable change of some properties of the substance. According to their origin, polymers are divided into two basic groups, viz., natural polymers and synthetic polymers. The most important classes of natural polymers are polysaccharides - basic structural materials of plants, proteins - fundamental structure. Materials of animals, and nucleic acids - carriers of genetic information. Synthetic polymers are modern materials surrounding us in everyday life as construction insulation or packaging materials, synthetic fibers, coatings, etc.The reactions by which all synthetic polymers and many natural polymers are formed from low-molecular-weight substances are controlled by laws of statistics and the resulting polymers comprise macromolecules with different molecular masses.

The relative amount of molecules with specific values of molecular masses in a polymer is described by a distribution function of relative molecular mass. The distribution function affects significantly many properties of polymers and is one of their important characteristics.

Synthesis of polymers

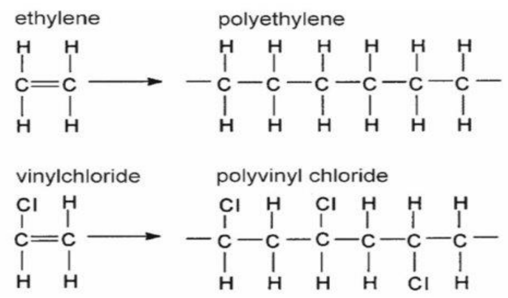
The mechanism of synthesis of natural polymers in living organisms, the biosynthesis, is extremely complex and is one of the most important topics in biochemistry. The Chemistry of formation of macromolecules can more easily be described with synthetic Polymers. Low-molecular-weight substances used for synthesis of polymers are called monomers. Because of their specific structure and reactivity, monomers can undergo a reaction, called polymerization, which converts monomers to macromolecular substances, that is polymers. As examples, two basic and relatively simple types of polymerization reactions will be described, namely, radical polymerization and poly condensation.

Figure.(3.2): Scheme of Radical Polymeriza tion



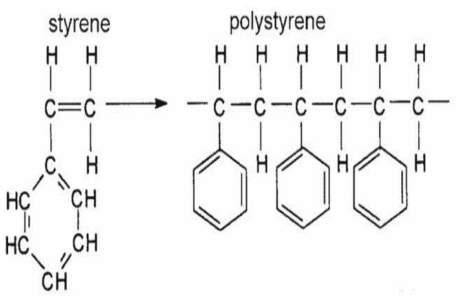
The ability of monomers to polymerize radically is most frequently conditioned by the Presence of a double bond between two adjacent carbon atoms in the molecule. Each of the two bonds is formed by two electrons shared by both carbon atoms. Through the action of substances called initiators, one of the bonds - figuratively speaking -disconnects in such a way that one of its electrons forms a bond with the initiator molecule and the second electron remains free, unpaired, for a short period of time. The structures with unpaired electrons are called free radicals, or just radicals, and hence the term radical polymerization. The radical resulting from the reaction of an initiator molecule with a monomer molecule has the potential to disconnect one of the two bonds of the double bond of another monomer molecule and so to attach to the other molecule giving two joined monomer units with a free radical. This addition reaction repeats several hundred up to several thousand times and in this way a polymer molecule builds up. The process of radical polymerization can be represented by the scheme shown in Figure 4.1.As an illustration, the structures of three simple, but industrially extremely important monomers and polymers formed from them are given in (Figures 4).

Figure (4): Monomers and Corresponding Polymers



The name vinyl chloride derives from the combination of the name of vinyl group (−CH=CH2) and the name of salts with chloride anions, i.e., chloride. The name is not quite rigorous, because the bond between vinyl and chlorine is a covalent, not ionic bond, which means that vinyl chloride is not a salt. A molecule of styrene consists of vinyl group −CH=CH2 and a benzene ring −C6H5. Thus, an alternative name of styrene vinyl benzene.

Figure (5):. Styrene and polystyrene



As far as the volume of production is concerned, the above three polymers are basic products of the huge industry of synthetic polymers, the world production of which amounts to tens of millions of metric tons. Condensation in organic chemistry means reactions in which two molecules join giving rise to a larger molecule while a small molecule, often a molecule of water, is eliminated. For instance, a carboxylic acid, the characteristic group of which is −COOH, reacts with an alcohol, the characteristic group of alcohols being −OH, with the elimination of molecule of water to form a molecule of ester (Figure 5.1).

Figure (5.1): Condensation of acetic acid with ethyl alcohol

$$CH_3CO\boxed{OH + H}OC_2H_5 = CH_3COOC_2H_5 + H_2O$$

acetic acid — ethyl alcohol — ethyl acetate — water

To utilize the principle of condensation for synthesis of macromolecules, we must start with a monomer, or more than one type of monomers the molecules of which have two or more functional groups capable of condensation. Thus, for example, suitable monomers for polycondensation are hydroxyl acids, with the general formula HORCOOH, each molecule of which contains both one carboxylic-acid and onehy droxy group. A multiplicity of condensation steps, by a poly condensation reaction as shown in above figure.

Poly condensation of a hydroxyl acid

(Figure 5.2). Formula of a section of a polyester molecule formed by poly condensation of a hydroxyl acid. An alternative way to synthesize polyesters is to start from two monomers, viz., dicarboxylic acid, general formula HOOCR1COOH,and adialcohol, diol, general formulHOR2OH. The reaction of these two monomers yields a polyester wit

Figure (5.2): Poly condensation of a Hydroxyl Acid

$$-R-COO-R-COO-R-COO-R-$$

Poly condensation of a dicarboxylic acid and a dialcohol

(Figure 5.3). Formula of a section of a polyester molecule formed by poly condensation of a dicarboxylic acid and a dialcohol In addition to radical polymerization and poly condensation,

There exist a large number of other important mechanisms of polymerization. Also the number of monomers and corresponding polymers is extremely large, in fact unlimited. Out of the vast amount of polymers described in the literature, only a minute fraction is produced industrially.

If more than one monomer is used in a polymerization reaction, the process is called copolymerization and the resulting polymer is a copolymer. Using various combinations so of monomers and varying their ratios in the copolymerization, a literally infinite number of copolymers can be prepared. The sequential distribution of the monomer units in the copolymer molecules plays the major role in determining the properties of the copolymer. The most important types of copolymers are statistical copolymers and block copolymers. In a binary statistical copolymer of monomers A and B, these quential order of monomeric units is controlled by some type of statistics and the structure of a segment of a copolymer molecule can be represented schematically as…AAABABBBAABBABB…. In a block copolymer, identical monomeric units form long sequences, thus A..AAA..AB..BB..BA..AAA..A would be as schematic representation of a tri block copolymer.

Figure.(5.3): Poly condensation of a dicarboxylic acid and a dialcohol

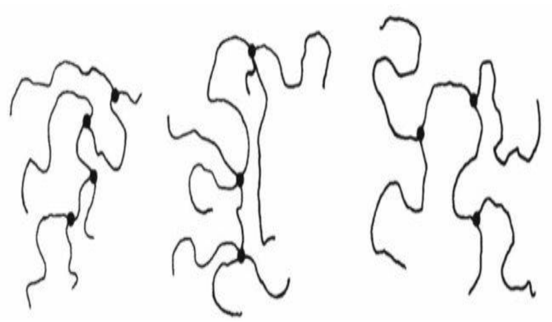
$$-R_1-CO-OR_2O-OCR_1CO-OR_2O-OCR_1CO-$$

Structure of Macromolecules

By the reactions described in Section 2, essentially linear, chain-like macromolecules are formed. Parts of a molecule adjacent to a single bond rotate about this bond. In atypical macromolecule, there are a large number of single, mostly C−C bonds. An isolated macromolecule, e.g., in highly dilute solution, assumes - due to the fast rotation

Of its parts about all single bonds - in time a large, virtually infinite number of conformations from densely coiled to extended ones. By far the most frequent conformations are those called statistical or random coil (Figure 8). In the domain occupied by a macromolecule with random-coil conformation, the segments of the macromolecule occupy just a small volume fraction of the volume of the domain, typically a few per cent or even less, most of the space being occupied by solvent molecules or segments of other macromolecules. The concept of statistical coil is of Prime importance for the understanding of the relations between the structures of polymers. If some or all monomer molecules in a polymerizing system have two double bonds, or more than two groups capable of undergoing a poly condensation reaction, the resulting macromolecules are not linear but branched (Figure 9). For instance, when a monomer molecule with three functional groups capable of condensation is incorporated in macromolecule, it can become a trifunctional branch point because three chains can emanate from it. Similarly, a monomer molecule containing two double bonds or four functional groups capable of condensation can give rise to a tetra functional branch point in a forming macromolecule because four chains can meet at this point. Branch points can also be generated in existing macromolecules by irradiation, heat treatment, aging and some other processes. There are several types of reactions that result in branched macromolecules with trifunctional branch points in which the macromolecular side Chains are attached to the main chain, the backbone; macromolecules of this type are

Figure (6): Sketches of branched macromolecules. a) Tri functional branch points; b) Tetra functional branch points; c) graft macromolecule



Implementation of polymer electronics

Microelectronics technology in conjunction with silicon is flexible enough to easy rolling up of circuits that consume less power and above all they can be manufactured at a fraction of cost involved in making semiconductor chips. This technology has number of upcoming areas of interest where lot of research is going on to manufacture microelectronic components on plastic substrates which would allow manufacturing of gadgets through just printing process. In this paper I would like to impart my ideas on INKJET PRINTING TECHNOLOGY which plays main role in printing polymer circuits, ELECTRONIC PAPER, construction and manufacturing of Plastic batteries, medicinal applications of Polymer electronics using RUBBER CIRCUITS and ELECTRO ACTIVE POLYMER and ORGANIC LED (OLED). If this technology emerges practically, the world of electronics will take a new leap.

In today's world of ever-expanding technology, Polymer electronics is going to change the whole world of consumer electronics and form the principal root for the major advancement in the design of electronic circuits and manufacture of printed circuit boards (PCB).The era of polymer electronics has taken a great start and all the technological companies have turned their entire research towards Polymer electronics. We hope that, in the forthcoming years Polymer electronics will accelerate the pace of the technological advancements and describe a new dimension in the near future.

Importance of polymer electronics

Silicon has largely influenced the Electronics industry and would continue to do so over a period of time. However, technologists are now looking at other alternatives, mainly "PLASTIC CIRCUITS", to meet our future needs. Here is a look into how plastics would influence the world of electronics.

The study of usage of polymeric materials in electronics is termed as "POLYMER ELECTRONICS" this polymer electronics has some advantages over silicon technology.

Components

1. Easy Manufacturability (mass production).
2. Electronic paper.
3. They can be recycled and reused (decreases environmental stress).
4. Consumes less power.
5. They are mobile, small, and light in weight.
6. They are used to make display devices that have extraordinary picture quality.

The feasibility of developing entire electronic components on basis of polymers is met by "INKJET PRINTING TECHNOLOGY" and is illustrated by several applications such as electronic paper, plastic batteries, etc.

Printing method on polymer electronic systems

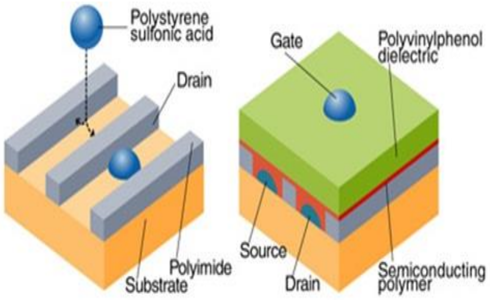
Inkjet printing technology

The huge cost of manufacturing Silicon microchip is due to the large complex processes involved. Photolithographic techniques are used to pattern wafers with microcircuit, which is grown in powerful vacuum, while the wafers are baked at temperatures of several hundred centigrades.The INKJET PRINTING TECHNOLOGY provides continuous production line of plastic circuits on plastic substrates and then cut into individual units. The substrates are made of acetate material that is as transparent as vugraph sheets. This printing technology plays a major role in the development of "flat screen" displays.

Principal of polymer electronics

A piezoelectric a piezoelectric material expands when a voltage is passed across it, pressing on a reservoir fluid and sending droplets flying out on to the substrates. Here, the construction of "TOPGATE TRANSISTOR" is explained below.

Figure (7): Top gate transistor



Construction of topgate transistor

The water based droplets contain an organic conductor-POLY(3,4- ethylene dioxin thiophene)doped with a solution of polystyrene sulphonic acid otherwise known as PEDOT/PSS.As the droplets dry they become a conducting layer and form source and drain of a transistor. They are then coated with a layer of semiconducting polymer (9, 9-dioctyl flourene-co-bithiophene) followed by a dielectric layer of polyvinyl phenol. Finally gate is printed, creating a so called top gate transistor. How the semiconductor polymer dries is very crucial.

Working

The molecular chains must line up in a way that makes it easy for an electron to hop from one chain to another, but the polymers tend to form into disordered microstructure that reduces electron charge.

Resolution of the screen can be improved by coating glass substrate with a hydrophobic film of polyimide pattern. When the water based droplets fall on the surface they are forced away from the hydrophobic regions in the required pattern.

Plastic Batteries

Plastic batteries are new type of low power batteries that do not require a case and are thin enough to be printed on a paper. They are of low cost and can be mass produced as the battery material is roughly 0.5 millimeters thick.

Construction

1. The new battery consists of 3 different layers.
2. It has conventional zinc manganese dioxide components as anode and cathode which are thin
3. Foil-like plastic sheets.
4. Electrolyte is a polymer gel placed between electrodes.

Uses

A They can be used for incorporating power source in integrated circuits.

The polymer battery system can be used to power space satellites, giving them uninterrupted power supply by harnessing solar energy.

Figure .(8): Polymer battery

Conclusion and future scope

In today's world of ever-expanding technology, Polymer electronics is going to change the whole world of consumer electronics and form the principal root for the major advancement in the design of electronic circuits and manufacture of printed circuit boards (PCB).The era of polymer electronics has taken a great start and all the technological companies have turned their entire research towards Polymer electronics. So I conclude that, in the forthcoming years Polymer electronics will accelerate the pace of the technological advancements and describe a new dimension in the near future.

Result

This chapter includes the explanation and result of the polymer electronics.

Organic LEDS

An organic light emitting diode (OLED) is a light emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This layer of organic layers is situated between two electrodes; typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, portable systems such as smart phones, handheld game consoles and PDAs. A major area of research is the development of white OLED devices for use in solid-state lighting applications.

There are two main families of OLED: those based on small molecules and those employing polymers. Adding mobile ions to an OLED creates a light-emitting electrochemical cell (LEC) which has a slightly different mode of operation. An OLED display can be driven with a passive-matrix (PMOLED) or active-matrix (AMOLED) control scheme. In the PMOLED scheme, each row (and line) in the display is controlled sequentially, one by one,[4] whereas AMOLED control uses a thin-film transistor backplane to directly access and switch each individual pixel on or off, allowing for higher resolution and larger display sizes.

An OLED display works without a backlight because it emits visible light. Thus, it can display deep black levels and can be thinner and lighter than a liquid crystal display (LCD). In low ambient light conditions (such as a dark room), an OLED screen can achieve a higher contrast ratio than an LCD, regardless of whether the LCD uses cold cathode fluorescent lamps or an LED backlight.

Figure (9): OLEDS and LEDS

Conclusion

In this chapter we have shown the result and explanation of the seminar report.

Conclusion and future scope

This chapter includes the conclusion and future scope of the polymer electronics systems.

Advantages

1. Easy Manufacturability (mass production).
2. Low cost.
3. They can be recycled and reused (decreases environmental stress).
4. Consumes less power.
5. They are mobile, small, and light in weight.
6. They are used to make display devices that have extraordinary picture quality.

Disadvantages

1. More complex.
2. Research is still on going to increase performance.
3. Lower mobility.

Applications

1. Fabrication organic thin film transistors.
2. Non-volatile memory devices based on organic transistors.
3. Fabrication of organic photovoltaic cells.
4. Fabrication of Organic light emitting devices.
5. Ferroelectric polymers for thin film devices.
6. Gene sensors.
7. Printed electronics.
8. Conducting polymer actuators and micro pumps.
9. Responsive membranes hybrid plastics.
10. Solar cells.

Future scope

In today's world of ever-expanding technology, Polymer electronics is going to change the whole world of consumer electronics and form the principal root for the major advancement in the design of electronic circuits and manufacture of printed circuit boards (PCB).The era of polymer electronics has taken a great start and all the technological companies have turned their entire research towards Polymer electronics. So I conclude that, in the forthcoming years Polymer electronics will accelerate the pace of the technological advancements and describe a new dimension in the near future.

Conclusion

This seminar report includes the theory of operation for "polymer electronic system" and we got the output.

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