P.S.V

COLLEGE OF ENGINEERING & TECHNOLOGY

KRISHNAGIRI

Department of Electronics & Communication Engineering

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ELECTRO FORUM

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A TECHNICAL MAGAZINE

ABOUT DEPARTMENT

The Electronics & Communication department was established in the year 2008. The department offers 4-year UG programs with an intake of 60 students, affiliated with Anna University, Chennai. The department aims to develop the student community to face the future world with the latest technical knowledge through research, good leadership qualities, industry-institute interaction, and a spirit of competence. It is supported by experienced and skilled faculty members in all areas and facilitated with well-equipped laboratories. The department conducts a broad range of multidisciplinary research initiatives in cutting-edge technologies, having MoUs with many reputed companies.

VISSION

To facilitate a conductive teaching-learning atmosphere to the aspirants in the domain of Electronics & Communication and make them globally proficient, innovative and socially responsible citizen.

MISSION

- To provide strong fundamental knowledge in the field of Electronics & Communication Engineering.
- To prepare students with exceptional skills and make them capable to provide solutions to the global community in the field of Electronics & Communication Engineering.
- To discover and disseminate knowledge through learning, research and transferring them to the Society for serving at a large.
- To make the students for long-term learning to provide solutions to the new issues arise in the global environment

CHAIRMAN MESSAGE

Dear Readers,

It gives me immense pleasure to extend my warmest greetings to all the readers of the Electro Forum Technical Magazine, the Department of Electronics & Communication Engineering, I am proud to witness the remarkable strides our department has made in fostering innovation, research, and academic excellence.

Our commitment to staying at the forefront of technological advancements is reflected in the diverse range of articles and insights presented in this magazine. The dedication and hard work of our faculty, students, and staff have culminated in a vibrant and dynamic academic environment, one that nurtures curiosity and encourages the pursuit of knowledge.

Electro Forum is not just a technical magazine; it is a testament to the collaborative spirit and intellectual vigor that defines our department. Each edition is a celebration of the brilliant minds that contribute to the ever-evolving field of Electronics and Communication Engineering.

I extend my heartfelt congratulations to the editorial team for their unwavering dedication and meticulous efforts in bringing this magazine to life. I am confident that the readers will find the content both enlightening and inspiring.

Thank you for your continued support and interest in ECE department. Together, let us continue to push the boundaries of what is possible and pave the way for a brighter technological future.

-Dr.P.Selvam,M.A.,B.Ed.,M.Phil.Ph.D.,
CHAIRMAN

SECRETARY MESSAGE

Dear Readers,

The latest edition of the Electro Forum Technical Magazine, a distinguished publication from the Department of Electronics & Communication Engineering.

As the Secretary, I am honored to be part of a team that is dedicated to excellence in education, research, and technological advancement. This magazine is a testament to the hard work and innovative spirit of our faculty, students, and staff. It serves as a platform to share their pioneering research, innovative projects, and insightful analyses that shape the future of electronics and communication engineering.

Electro Forum is not merely a collection of technical articles; it embodies our department's commitment to fostering a culture of learning, discovery, and innovation. Each article in this edition reflects the dedication, creativity, and intellectual rigor of our contributors.

I extend my sincere gratitude to the editorial team for their relentless efforts in bringing this magazine to life. Their passion and attention to detail have been instrumental in making this publication a success. I also thank our readers for their continued support and engagement.

As you explore the pages of this magazine, I hope you find inspiration and valuable insights that will ignite your passion for electronics and communication engineering. Together, let us continue to innovate, explore, and contribute to the ever-evolving world of technology.

-Dr.S.VIVEK,M.A.,MBA(UK).,Ph.D.,
SECRETARY

PRINCIPAL MESSAGE

Dear Readers,

It is with great pleasure that I extend my warmest greetings to all the readers of the Electro Forum Technical Magazine. This publication is a testament to the dedication and excellence that define the Department of Electronics & Communication Engineering.

As the Principal, I am immensely proud of the strides our department has made in fostering an environment of innovation, research, and academic excellence. The Electro Forum Technical Magazine serves as a platform to showcase the remarkable achievements and pioneering work of our faculty, students, and staff.

This magazine is not just a collection of articles; it is a reflection of the intellectual curiosity, technical prowess, and collaborative spirit that our department embodies. Each edition highlights the cutting-edge research, innovative projects, and insightful analyses that contribute to the advancement of electronics and communication engineering.

I would like to express my heartfelt appreciation to the editorial team for their tireless efforts in bringing this magazine to life. Their passion, dedication, and meticulous attention to detail have made this publication possible. I also extend my gratitude to our readers for their continued support and interest in our department's endeavors.

As you explore the pages of this magazine, I hope you find inspiration and valuable insights that will ignite your passion for electronics and communication engineering. Together, let us continue to push the boundaries of knowledge and technology, paving the way for a brighter future.

Dr.P.LAWRENCE,M.E.,Ph.D.,
PRINCIPAL

HoD MESSAGE

Dear Readers,

I am thrilled to welcome you to the latest edition of the Electro Forum Technical Magazine, an esteemed publication of the Department of Electronics & Communication Engineering.

As the Head of the Department, it is my privilege to witness the continuous growth and accomplishments of our faculty, students, and staff. This magazine is a reflection of our collective efforts to excel in education, research, and innovation. It showcases the cutting-edge research, innovative projects, and insightful analyses that define our Department's contribution to the field of Electronics and Communication Engineering.

Electro Forum is more than just a magazine; it is a celebration of the intellectual curiosity and technical prowess that our department fosters. Each article within these pages represents the dedication, creativity, and scholarly excellence of our contributors.

I extend my heartfelt appreciation to the editorial team for their exceptional work in curating this magazine. Their dedication and meticulous attention to detail have brought this publication to fruition. I also thank our readers for their ongoing support and engagement with our department's endeavors.

As you navigate through this edition, I hope you find the content both enlightening and inspiring. Let us continue to push the boundaries of what is possible and contribute meaningfully to the ever-evolving world of technology.

Prof.C.THAMILARASI,M.E.,
HoD/ECE

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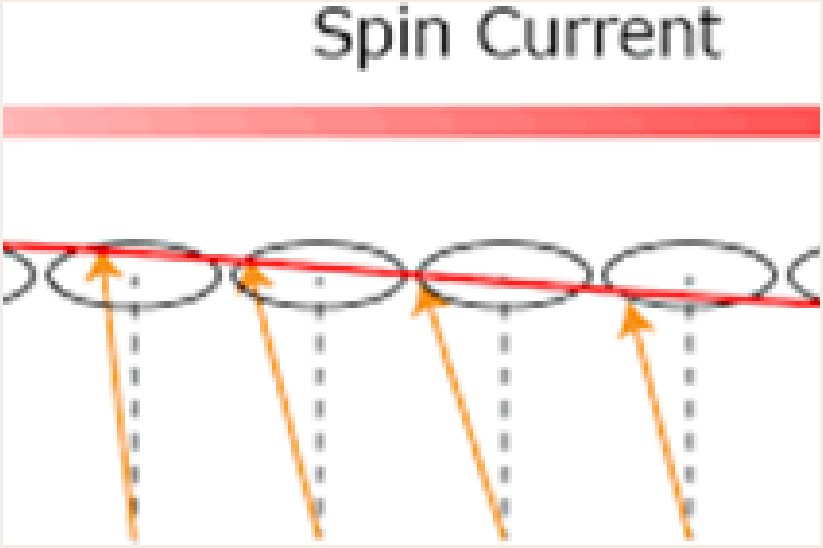
NEXT GENERATION SPIN WAVE TECHNOLOGY

INNOVATIVE IDEAS

Introduction

Our lives have undergone a significant transformation as a result of the electronic information technology revolution in just a few decades due to the rapid advancement of science and technology. The technical advances of this decade are beyond anything people could have imagined a century ago. Throughout the past 60 years, integratedcircuits, which were firstcreated in 1959, have advancedquickly.

Electronics itself has seen a remarkable advancement in nanotechnology, enabling the creation of smaller,quicker, and more effective devices. The study of electronic devices with nanoscale dimensions is the focus of the rapidly growing area of Nano electronics. In the field of Nano electronics, spin waves, commonly referred to as magnons, are a promising technology for next-generation computing. All of the the computers that house our data share a similar trait. A semiconductor chip that stores and processes information is known as CMOS technology. Up until now, more computer power has simply meant more chips, each one smaller. Engineers have little choice but to examine alternatives to CMOS, though, as we're slowly approaching a brick wall when it comes to scaling. One such idea is spin waves , which are essentially the propagation of perturbations in the alignment of spins in magnetic materials. They behave like electromagnetic waves and have an inherent benefit.



These magnetic excitations have already been successfully exploited by Albisetti in a platform for analogue computing, and they can be used for memory and computation applications as well. Thecollective excitation of electron spinsin a magnetic substance resultin spin waves. They are an excellent choice for low power consumption computer applications because they can propagate over vast distanceswithout suffering much from energy loss. This makes spin waves an intriguing possibility for Nano electronics in the future. Like electrical impulses in traditional computers, they can be used to transport and process information.

Quantum Spin-WaveMaterials Interface Effects

With the continuous miniaturization of electronic devices and the increasing speed of their operation, solving a series of technical issues caused by high power consumption has reached an unprecedented level of difficulty. Fortunately, magnons (the quanta of spin waves), which are the collective precession of spins in quantum magnetic materials, making it possible to replace the role of electrons in modern information applications.

The subjectof spin waves for next-generation computing is quicklydeveloping, with fascinating in- novations and patternsthat are influencing the direction of computing. The following are some major developments in spin waves for next-generation computing:

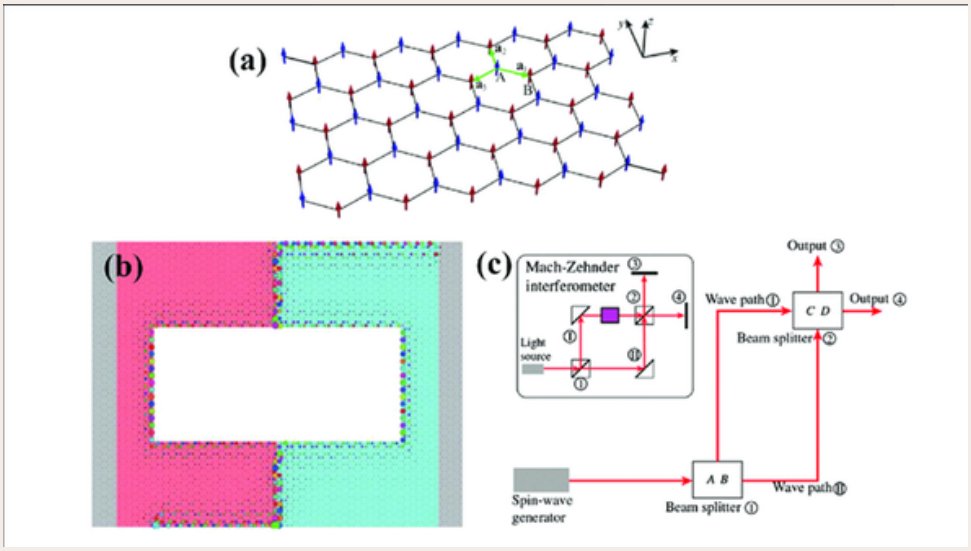


Fig : Schematic diagram of perpendicularly magnetized ferromagnet with a honeycomb lattice for propagating TESWs (Courtesy : ResearchGate)

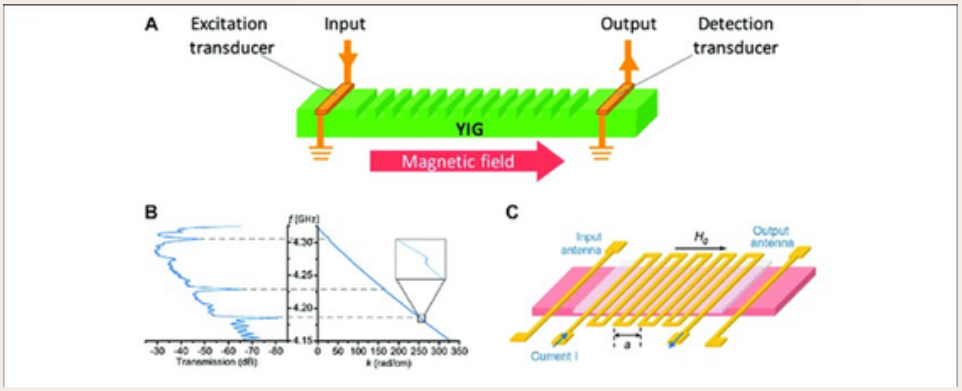
• **Integration with conventional electronics** : To produce hybrid systems that combine the best features of both worlds, spin wave-based devices are being combined with traditional electronics. New memory and logicdevices based on spin wavescan be created thanks to this integration and be used with traditional electronics without any issues.

• **Spin wave generation and detection improvements** : Much progresshas been achievedin creating effective techniques for producing and detecting spin waves. In order to produce and detect spin waves, researchers are investigating novel materials and methodologies such as spin-orbit coupling, spin Hall effect, and magnetoelectric.

Development of New Spin-Wave Material Systems

Antiferromagnets are highly ordered magnetic materials having symmetrical magnetic moments that are periodic. Antiferromagnetic materials, in contrast to ferromagnetic materials, have two sets of opposite magnetic sublattices that are tightly connectedand adjacentatoms' magnetic moments that areantiparallel (Kittel, 1951).Antiferromagnetic materials hence look macroscopically to be nonmagnetic below Neel temperature.

Spinwaves and magnonshave received a lot of interest recentlyfrom scientists. Antiferromagnetic materials (particularly NiO) have demonstrated distinct advantages in spin-wave manipulation at high frequency and high speed by utilisingother technologies.



Future Prospects

A promising area that provides many intriguing opportunities for the future of computing is spin waves for next-generation computing. With possible improvements in efficiency, storage capacity, dependability, novel computing paradigms, commercialisation, and applications in 5G and other communication networks, the prospects for spin waves in next-generation computing seem bright. A more effective and sustainable future may be possible with the continuous research and development of spin wave-based technologies, which have the potentialto completely alterhow we processand store information.

Here are some of the potential future prospects for spin waves in next-generation computing:

·Increased efficiency and speed : Spin wave-based devices have the potential to be more energy-efficient and fasterthanconventional electronics.

·Higher storagecapacity : Spin wave-based memorydevices have the potential to store more data in a smaller space compared to conventional memory devices.

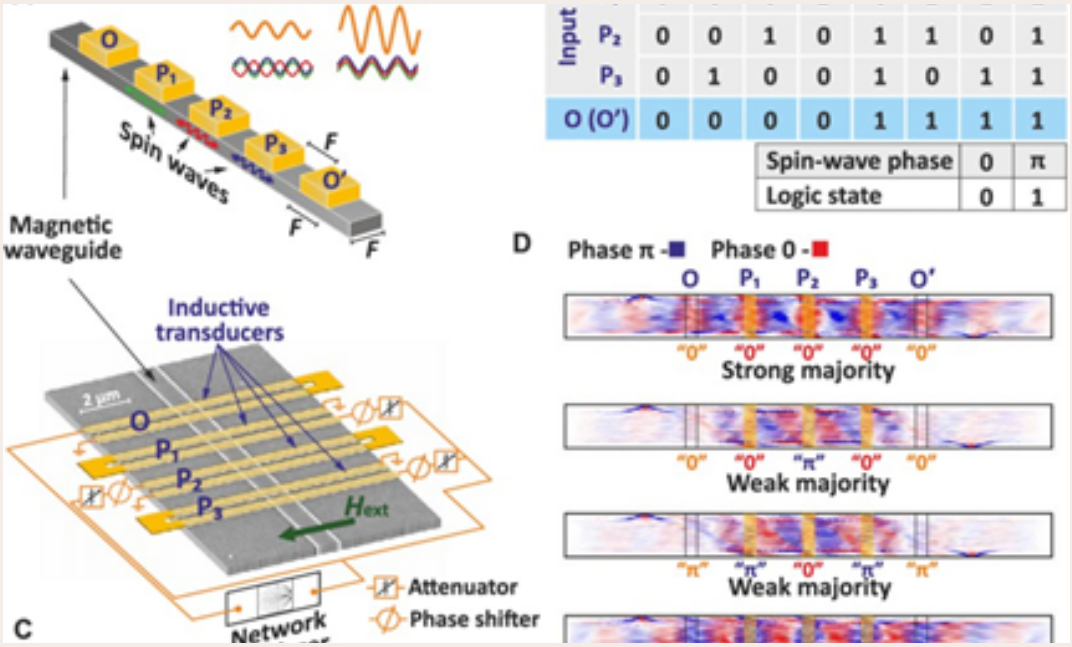


Fig: Device structure and operation principle of the inline SWMG

· **Improved reliability** : Spin wave-based devices are less susceptible to electromagnetic interference and noise compared to conventional electronics.

·Commercialization of spinwave-based device: As research in spin wave-based devices advances, there is a growing interest in commercializing these technologies.

· **Spin waves in 5G and beyond** : Spin waves could play an important role in the development of 5G and beyond communication networks.

Applications

Figure shows the applications and link scenarios for

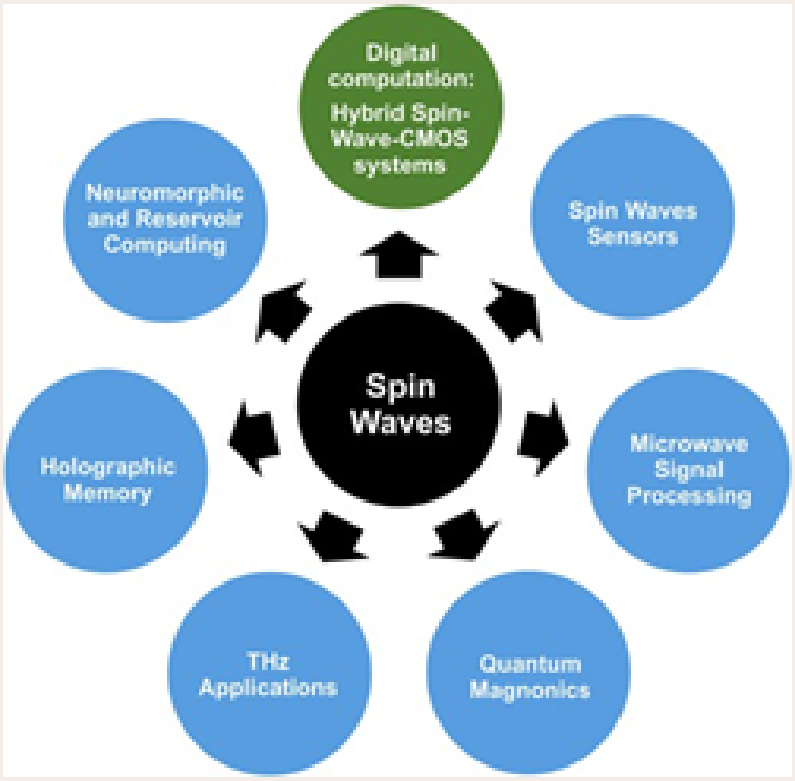


Fig : Applications of spin wave

Conclusion

To sum up, spin waves for next-generation computing is a rapidly developing topic that presents a wide range of intriguing prospects for the development of computing in the future. Spin waves, which are the collective excitations of spins in magnetic materials, are appealing for application in next-generation computer systems because of their distinctive features. They have the potential for greater energy efficiency, more storage, and faster calculation rates and are less vulnerable to electromagnetic interference.

-SWETHA S
IV Yeear

TEXTILE BASED ELECTROCHROMIC DISPLAY

INNOVATIVE IDEAS

Introduction

Chromic materials are materials which exhibit a reversible colourchange in responseto an external stimulus such as temperature (thermochromism) and light (photochromism). The source of the colour changesis the variation in absorption spectra of the materials across the UV-visible-near-infrared (NIR) region.Besides the above-mentioned stimuli, oxidation and reduction of certain substances upon appli- cation of an electricalbias can also lead to distinct photo-optical and colour changes. This phenomenon is known as "electrochromism". Electrochromic (EC) materials generally exhibit colour changes between two coloured states or between a coloured state and a bleached state. Materials that reveal coloured hues in their oxidised or reduced states are referred to as anodically colouring or cathodically colouring respectively. Several EC materials that exist in multiple redoxstates reveal the unique abilityto switch between severalcoloured states. This is known as polyelectrochromism. EC materials are highly applicable in smart windowsand optical displaytechnology. Furthermore, as the regionof optical changescan be extended beyond the UV-visible region into the NIR, the thermal infrared and even the microwave region, these EC materials are potentially useful in defence related applications.

History of Electrochromism

The first EC device was documented by Deb in 1969, where he demonstrated the controlled and reversible changing of colour with the use of tungsten trioxide (WO_3). Since then, many classes of EC materialsand corresponding devices have been reported, which include metal oxides, viologens and conjugated polymers.Due to their facile colour changes in the visibleregion, EC materialswere highly sought after and employedfor optical display applications. Early research in the US, Soviet Union, Japan and Europe on EC materials were motivated by their potential applications in information displays. There were intenseresearch efforts during the firsthalf ofthe 1970sat severallarge internationalcompanies such as IBM, Zenith Radio,the American CyanamidCorporation and RCA in the US as well as Canon in Japan, Brown Boveri in Switzerland and Philips in the Netherlands.

Through the years, electrochromism continues to receive wide attention in the area of fundamental research. In the mid-1980s, interest in EC materials was boosted again given the potential application in fenestration technology, which was deemed as a way to achieve better energy-efficiency in buildings. The newly conceived "smart" window technology could vary the transmittance of light and solar energy,leading to energysavings and indoorcomfort. Moving on, breakthroughsin deviceengineering and manufacturing techniques allow for electrochromism to move beyond traditional applications such as smart windows and optical displays into emerging applications such as wearable electronics and defence-related technologies.

Mechanism of Electrochromism

The structure consist of electrode, Electrolyte, Electrochromic Polymer and Substrate. The substrate act as a base on which the coating is given. The Electrode is used to establish electrical contact. It emits or collects electron or control their movement. Electrolyte serve as catalyst to make it conductive by promoting the movement of ions from the cathodeto anode on charge and in reverseon discharge. Electrochromism happens in Electrochromic materials like viologens, transition metal oxides, conducting polymer. So here they use Electrochromic polymer.

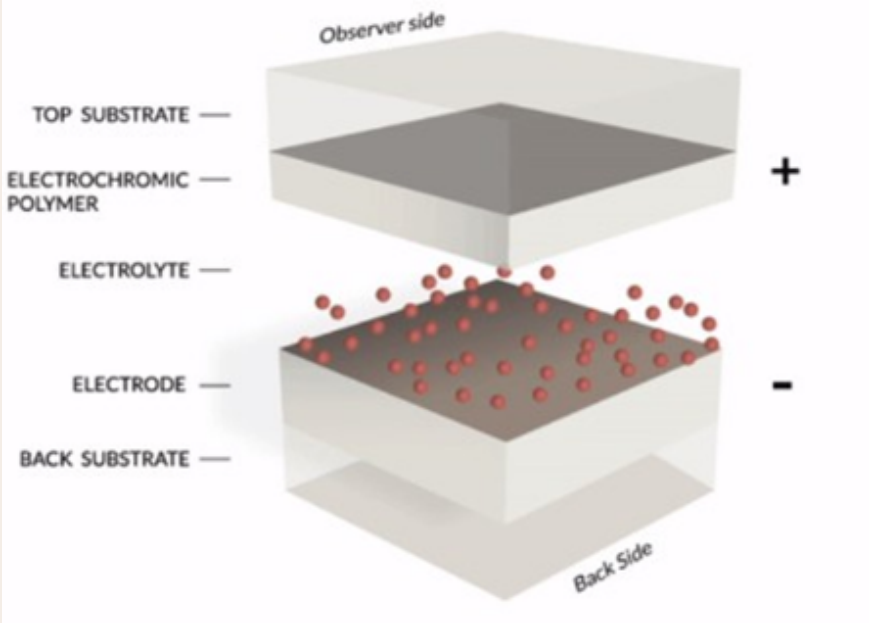


Fig 1: Working of Electrochromism (Courtesy : IEEE Xplore)

Avoltage is appliedto the outer conductor. Say we use Li ions as electrolyte. Now Li ions move from theinner most electrode to the outermost one i.e the conducting Polymer.When a voltage is appliedto the electrodes the ions migrate to the conducting polymer. When they into that layer they make it reflect light, effectively turning it opaque. They remain there all by themselves until the voltage is reversed.

Design and Development

Generally, the electrochromic device contains four basic ingredients as an electrochromic material, an electrolyte, conducting electrodes, and a substrate. Due to a lot of favorable properties of PEDOT:PSS as an electrochromic material, it is suitable for the incorporation as an electrochromic material. The H_3PO_4 gel electrolyte has inorganic HC ions, which is having higher mobility with maintaining its biocompatibility. Hence we use H_3PO_4 gel as an electrolyte. An aluminum sheetis used as a counterelectrode. A textile fabric act as a substrate. For the preparation of the electrochromic solution, the PEDOT:PSS was mixed with demineralized water and stirredthis mixture for approximately 10 minutes. In this mixture, 5% Dimethyl sulfoxide was dropwise added continuously stirred the mixture for 10 minutes more. The first step of the display production was to perform the coating of this solution onto the substrate. After a lot of iterations and comparison of different fabrics, the polyester-based flex printing fabric of 140 dtex has been selectedfor working as a substrate for our electrochromic displaying electrode.The coating has been done by manual dipping of a 2 cm x 2 cm polyester fabric, several times (3 to 4). For proper drying, this coated fabric was placed in an oven at 100 oC for 20 minutes.

Applications

In the quest for automatization in the automobile interiors, this device can provide big support as it is a very flexible, robust, optimized structured, economical, biocompatible, very high cycle life, fast switching, and run at very low voltage(2.0 V). With the application of voltage, electrochromic displays offer a platform in which light's properties can be continuously and reversibly manipulated. These devices have been proposed for use in windows, energy-saving electronic price tags, flashy billboards, rear-view mirrors, augmented virtual reality and even artificial irises. As an inevitable display technology in the near future,non-emissive see-through displays will be ubiquitous and irreplaceable as a part of the Internet of Things, in which physical objects are interconnected through software.

Future Scope

The seven-segment display was also fabricated in a similar process as the two-segment display was formed, it means incorporating one device by one individual segment and controlled by a microcontroller circuit board. On a positive note, the operation of the seven-segment display was observed by this arrangement, but due to the number of wired connections complexity of the seven similar devices, the controlling and fixation was very difficult. As result, this seven-segment display was not very stable.

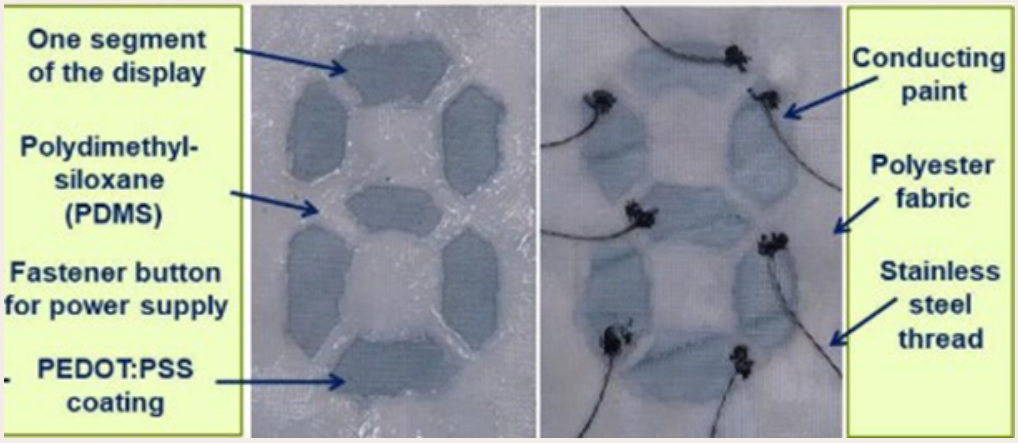


Fig: Seven-Segment Display (Courtesy : IEEE Xplore)

Therefore, in the future, this seven segment display will come into existence by making a seven-segment display in a single fabric. With the incorporation of polydimethylsiloxane (PDMS),we can provide the shape of each segment.By using conducting paint and stainless-steel thread the supply to each separate segment will be provided.The current electrochromic device is tested at room conditions. In the future, this device will be tested and modify accordingly for extreme conditions of temperature, humidity, and sunlight. There is one more concern is the washability of PEDOT:PSSbased electrochromic device.Yet, the coating of the silicon layer on the top of the electrochromic device is one the best solution to improve washability but, it needs more in-depth research to improve washability. This is also a future goal of this work.

Conclusion

The developed electrochromic device is having only a three-layer structure with the textile substrate. The materials which are used to fabricate the electrochromic device is supporting the biocompatible aspects. Different fabrics and dilution ratios of PEDOT:PSS solutions have been tested. The readymade 140 dtex polyester flex printing-based textile fabric directly coated by 2.0 times ratio diluted PEDOT:PSS solutions was performed the best for the two-segment electrochromic display. The simple structured display device is having a very high life cycle as it can run up to 2500 cycles without degradation. It is highly flexible androbust as it can function properly even after 1500 times of bending.

-LAVANYA S
IV Year

3-D PRINTED BONES

INNOVATIVE IDEAS

Introduction

3D printing, that is, additive manufacturing, has solved many major problems in general manufactur- ing, such as three-dimensional tissue structure, microenvironment control difficulty, product production efficiency and repeatability, etc., improved the manufacturing speed and precision of personalized bone implants, and provided a lot of support for curing patients with bone injuries. The application of 3D printing technology in the medicalfield is gradually extensive, especially in orthopedics. The purpose ofthis review is to provide a report on the related achievements of bone implants based on 3D printing technology in recent years, including materials, molding methods, optimization of implant structure and performance, etc., in order to point out the existing shortcomings of 3D printing bone implants, promote the development of all aspectsof bone implants, and make a prospect of 4D printing, hoping to provide somereference for the subsequentresearch of 3D printing boneimplants.

The need for 3D printed bones

Human bones have the ability to self-repair and regenerate, but this ability is limited . When the bone damage exceeds its acceptable capacity, it will lose its self healing function and require artificial repair. The ideal treatment is to repair the damaged area by transplanting bones from other parts of the patient himself, thus possessing the same bone conduction ability.The application of this methodis limited by the limitation of transplantable bones at the donor site of patients and the possible complications at the donor site after transplantation . The second reason is that the donor bone is from other people, so that enough donors can be obtained. However, there is often non-specific immunity to reject the external donor, which poses great difficulties for bone repair . Therefore, in order to overcome these limitations of traditional bone repair, researchers started to study the possibility of replacing human bones with grafts.

3D printing technology plays a huge role in the biomedical field due to its unique advantages. Researchers use cells and biomedicalmaterials as discrete materials andmake use of the characteristicsof personalized customization of 3Dprinting to prepare different organsand tissuestructures, which will solve theproblem of insufficient organ donors to a large extent. In particular, for applications in bones and bone scaffolds, 3D printing offers a solution for the treatment of patients with complex bone defects. The intersection of 3D printingtechnology and the biomedical fieldwill surely becomea highlight of modern medicine. In the application processof 3D printing, in additionto the limitation of its own technology, the choice of printing materials also plays a vital role.

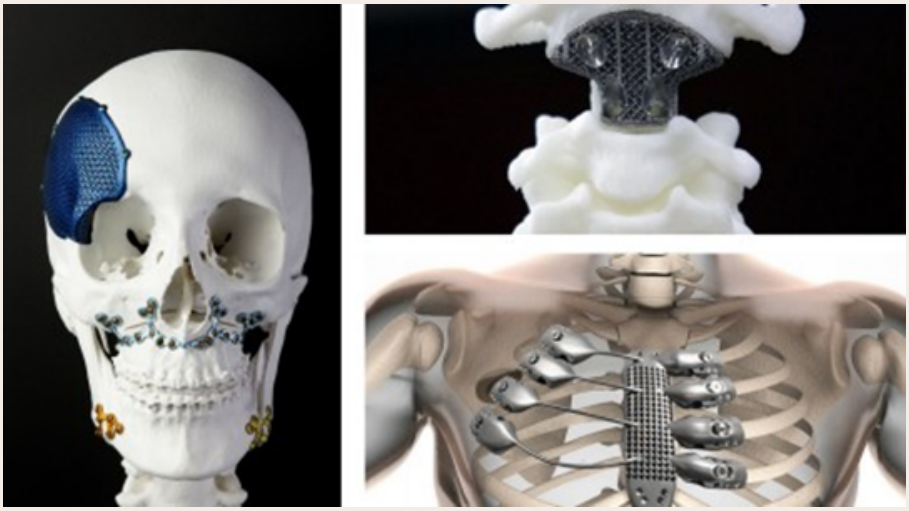


Fig. 1: 3D printed bones (Courtesy : Google)

Composition for BTE

Natural bone is a highly organized composite material, including about 60percent inorganic components. Its main components are hydroxyapatite crystals and about 30percent organic materials, mainly composed of type I collagen and a small amount of type V collagen, 5–10percent water and 3percent lipid. Natural human bones are structurally divided into periosteum, compact bone, cancellous bone and bone marrow. For BTE (bone tissue engineering), bioactivity covers two primary biological processes: osteo-conductivity and osteo-inductivity. At present, many materials have been used in BTE; their characteristics are shown in the table below.

TABLE I: Types of materials used in BTE and their advantages and disadvantages

Type of material	Advantages	Disadvantages
Metals	Biocompatibility, non-toxicity and corrosion resistance	Not biodegradable
BIOCERAMICS		
Bioactive glasses	Improve differentiation and osteogenesis	Low strength and brittleness
Hydroxyapatite	Bioactivity, biocompatibility, osteoconductivity, non-toxicity and non-inflammatory	Brittle, very slow degradation
Tricalcium phosphate	Supports in vivo osteogenic differentiation	Slow degradation, incompressible nature
NATURAL POLYMERS		
Collagen	Enzymatic biodegradability	Complexity of structure
Gelatin	Biocompatible, biodegradable	Poor mechanical properties
Chitosan	Support cell attachment, differentiation, and migration, non-toxicity, non-allergenicity, mucoadhesivity, biocompatibility, biodegradability and osteoconductivity	Poor mechanical strength
Hyaluronic acid	Biocompatibility, biodegradability, viscoelasticity, enzymatic biodegradability	Very rapid degradation and water solubility
Alginate	Biocompatibility, easy gelling, easy chemical modification	Non-degradable in mammals, sterilization causes degradation
Agarose	Wide range of gelling and melting temperatures, no need cross-linking agents, little inflammatory response in vivo	Poor cell attachment
SYNTHETIC POLYMERS		
Poly(α-hydroxy acids)	Degradation products can be excluded from the body	Degradation by bulk erosion, relatively poor mechanical properties, hydrophobicity of the polymer surface
Poly(ε-caprolactone)	Biodegradable, non-toxic, a low melting point	Hydrophobicity, slow degradation
Polyurethanes	Excellent mechanical properties, good biocompatibility	Toxicity of degradation products (from aromatic diisocyanate component)

Conclusion

Through summarizing the achievements of 3D printing technology in bone tissue engineering in recent years, we have found that it has great potential in this field. A qualified bone implant needs to meet the following tissue characteristics, cell structure pore size and porosity, mechanical properties, biocom- patibility, osteoconductivity and osteo-induction, and angiogenesis potential, which is still a challenge for the current research.Only by studying the relationship between these tissue characteristics and the manufacturing method, can we have the opportunity to develop more appropriate biomaterials that more closely approximate the hierarchical structure of natural bone.

-ARUNKUMAR R
IV Year

THE ELECTRONICS OF CHARGER ADAPTERS

INNOVATIVE IDEAS

Introduction

So, today when the world is rapidly undergoing a massive technological transformation, we have forgotten to think about the electronic device that influences our daily lives. After the current advancements in rechargeable battery technology, where the Lithium-ion cells are leading the race, they have made it into electric vehicles and even some advanced electronics after years of just being limited to handheld mobile phones, cameras, etc. These devices are recharged using "chargers" and specific cables,which double as a simple communication tool. In this article, we dive into the working of "charger adapters" and "USB cables", which don't get into the spotlight more often.

Charger Adapters

In India, electricity is transmitted using the standard 240V 50Hz.Recently, the connector pin of the LED lighting got damaged, it took me only a few minutes to cut away the pin and insert the wires directly into the socket,but the device still works like magic.

Fig. 1: A charger adapter (Courtesy : Wikipedia)

Now, this isn't the case with charger adapters. If we try out the same way, by inserting USB cables directly into the socket,the corresponding electronic device may get burned and will be permanently damaged. Electronic devices like mobile phones and laptops are designed to work with "Direct Current". As mentioned earlier, electrical components like LED lighting, water heaters, and washing machines, are designed to work with 240V "Alternating Current". That's why it isn't advisable to cross-connect the electronic devices without specific adapters.Adapters are designed to convert the incoming power supply into device-specific needs. For example, let us analyze a usual 5V DC charger adapter. It consists of a step down transformer, diodes, and capacitor, all of which together constitute a "bridge rectifier" circuit. The input of 240V is converted into 5V using the step down transformer. It's still Alternating Current. To convert it into DC, a bridge rectifier circuit is used.

The fundamental characteristic of a diode is that current can flow only one way through it, which is defined as the forward direction. A diode bridge uses diodes as series components to allow current to pass in the forward direction during the positive part of the AC cycle and as shunt components to redirect current flowing in the reverse direction during the negative part of the AC cycle to the opposite rails.

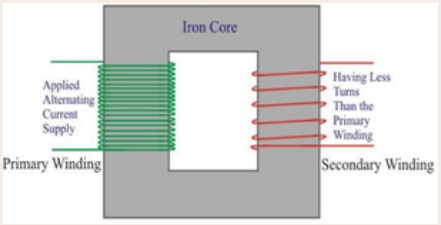


Fig. 2: Step Down Transformer (Courtesy : ResearchGate)

The fundamental characteristic of a diode is that current can flow only one way through it, which is defined as the forward direction. A diode bridge uses diodes as series components to allow current to pass in the forward direction during the positive part of the AC cycle and as shunt components to redirect current flowing in the reverse direction during the negative part of the AC cycle to the opposite rails.

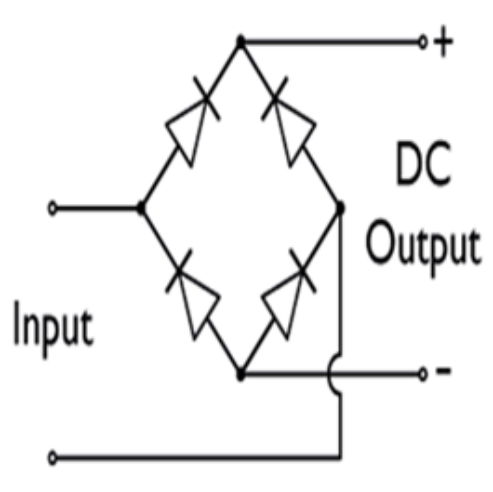


Fig. 3: A diode bridge (Courtesy : Wikipedia)

Theobtained output currentis now passed through a filter sincethe DC has a high ripple factor.For this, a capacitor is used. Capacitor charge till the waveform goes to its peak and discharge into Load circuit when waveform goes low. So when output is going low, the capacitor maintains the proper voltage supply into the Load circuit, hence creating the DC.

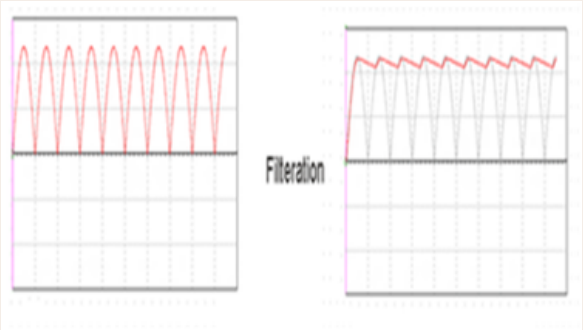


Fig. 4: Filteration

Thus, a charging adapter makes use of simple principles from electronics engineering. The amount of easiness this simple electronic device provides us in our daily life is invaluable.

Universal SerialBus

Before the development of USB (Universal Serial Bus), it was often tricky to connect external devices. Users sometimes needed to open up their computers and add hardware to give them the communications port they needed.The Universal Serial Bus, which was released in 1996 by Intel, simplified things.

. USB ports now are standard on personal computers and are built into many other electronic devices such as smartphones, eBook readers, and game consoles. USB type-C is the latest update to the physical connector.

The type-c cable boasts a data transfer speed of up to 40 GBPS along with a power supply range of up to 100 watts. The functions of 24 pins are as follow ;

1. 4 VBUS pins for power supply.
2. 4 ground pins.
3. 2 SBU pins, they carry other alternate modes.
4. 8 Receiver and Transfer pins for data transfer.
5. 2 CC pins which function as OTG pins.
6. 4 D pins for data transfer with OTG.

The USB type-c debuted with the 3.0 version. Followed by 3.1 and 3.2. The latest update is the "Thunderbolt" version. It caps a data transfer rate of 40 GBPS along with the caliber of replacing an HDMI cable displaying an 8K video. The fact that the above-mentioned pins are placed in the same reverse orders, makes the orientation very symmetric.

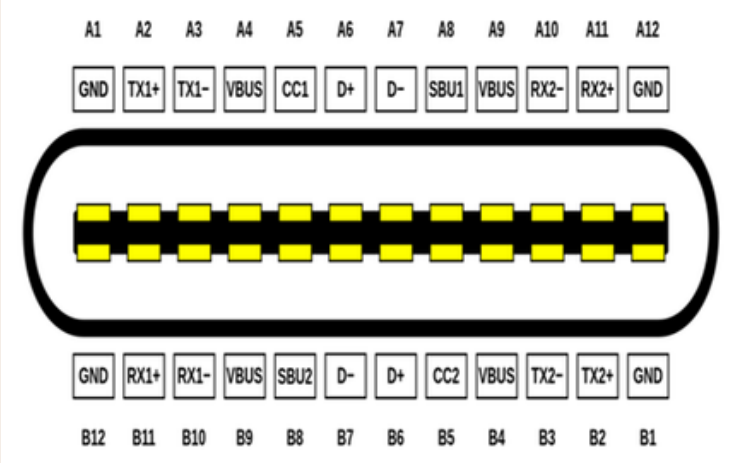


Fig. 5: Universal Serial Bus (Courtesy : Wikipedia)

Conclusion

That's how electronics engineers have an impact in our current technological era, where simplegame-changing circuits play an important role in making our lives better.

-JAYA KUMAR
III Year

QUANTUM DOT LED

INNOVATIVE IDEAS

Introduction

Television display technologies have come a long way since the first commercial color CRT was produced in 1954 and it was not untilthe late 1990sthat LCD technology began to surfaceand display technologies started evolving at an unprecedented rate. Gone are the days when the conventional cathode ray tubes(CRT) were the only thingfor television displays, the technology for which datesback to the early 19th century. Later the more efficient Liquid Crystal Displays (LCDs) came to the picture and which was quick to rise to fame because of its passivenature that combinedcharacteristics of low power and bright light viewing, factors that made portability a reality. LCD alone is not capable of emitting its own light. There should be a light source or backlight. A LED backlight used the three basic colors-blue, green, and red in order to come up with a white color light. Recently, one of the popular LED LCD colors is blue coated with a yellowishphosphor to achievea white light color and QD LED TV is found as amore advanced versionof this. The manufacturer no longer used the blue LED with yellowish, but instead they use QD particles for achieving white color. The QDLED absorbs the emitted blue light then transfer it to red and green to creatingthe desired white color. This process is also known for achieving an accurate LED colors.

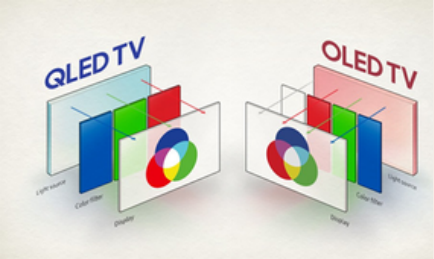


Fig. 1: QLED TV vs. OLED TV (Courtesy : Samsung Newsroom)

OLED is composed of organic molecules made of thin films that create light with the use of electricity. This type of lightning technology is capable of creating crisper and brighter displays on electronic devices than the traditional liquid crystal displays (LCD) and light emitting diodes (LED). Meanwhile, the Organic Light-emitting Diode (OLED) display is made of organic compound which releases light with the presence of an electric current. The pixel is capable of emitting light on its own. It only means that this type of LED display have no issues regarding back light leaking.

Quantum Dot LED, or simply called a QLED, displays are the next generation of display technology based on quantum-dots light emitting diodes. The technology is quite similar to OLED display technology, but with a quantum dot layer instead of the OLED emitting layer. Quantum dots incorporate the best aspects of both organic light emitters and inorganic light emitters. They don't emit the colors directly; in fact they create picture very differently by adding an additional layer of quantum dots which in turn dictates an ideal color temperature when hit by light from behind, resulting in an immersive viewing experience that sets in a new revolutionin television display technologies.

OLED

The acronym 'OLED' stands for Organic Light-Emitting Diode – a technology that uses LEDs in which the light is produced by organic molecules. These organic LEDs are used to create what are considered to be the world's best display panels.OLED displays are made by placing a series of organic thin films between two conductors. When an electrical current is applied, a bright light is emitted. A simple design which brings with it many advantages over other display technologies. OLED senable emissive displays which means that each pixel is controlled individually and emits its own light (unlike LCDs in which the light comes from a backlighting unit). OLED displays feature great image quality - bright colors, fast motion and most importantly - very high contrast. Most notably, "real" blacks (that cannot be achieved in LCDs due to the backlighting). The simple OLED design also means that it is relatively easy to produce flexible and transparent displays.

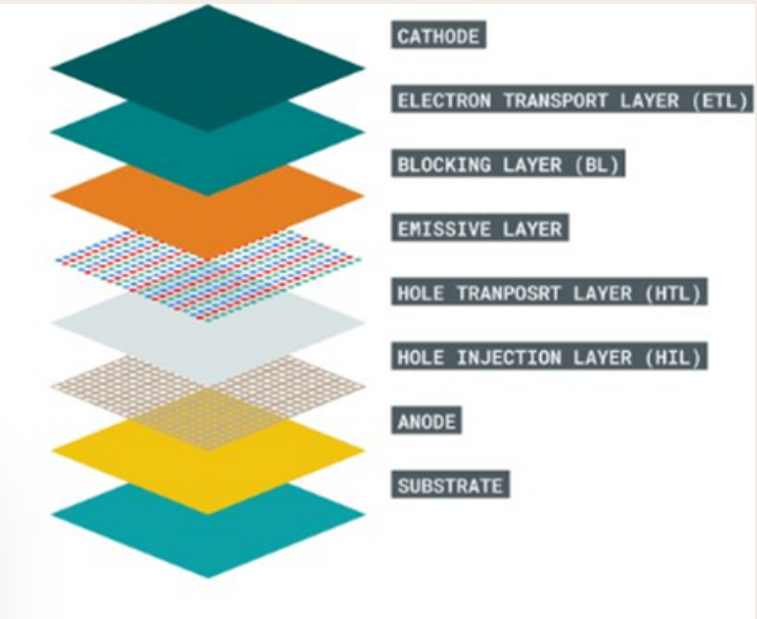


Fig. 2: OLED layer (Courtesy : Sensor Kit)

Operating principle of OLED

The conductive layer and emissive layers are made of special organic molecules that are helpful in conducting electricity. Anode and cathode are used for connecting OLEDs to the source of electricity. When power is applied to an OLED,the emissive layer becomes negatively charged and the conductive layer becomes positively charged. Due to electrostatic forces applied, the electrons move from the positive conductive layer to a negative emissive layer.This may lead to a change in electrical levels and creates radiation that varies in frequency range of visible light.

QLED

QLEDstands for QuantumDot Light EmittingDiode. A quantumdot display is a displaydevice that uses quantum dots (QD), semiconductor nanocrystals which can produce pure monochromatic red, green, and blue light. The structureof a QLED is very similar to the OLED technology. But the difference is that the lightemitting centers are cadmium selenide(CdSe) nanocrystals, or quantum dots.A layerof cadmium- selenium quantum dots is sandwiched between layers of electron transporting and hole transporting organic materials.An applied electric field causes electrons and holes to move into the quantum dot layer, where they are captured in the quantumdot and recombine, and emittingphotons. The spectrumof photon emission is narrow, characterized by its full width at half the maximum value. There are two major fabrication techniques for QD-LED, called phase separation and contact printing.

Difference between OLED and QLED

- **OLED :**

-Low input lag. Gamer's rejoice, these QLED's have an excellent input lag time. The 2018 version has recorded lag-time of just 15.4ms. No excuse to lose a match on this TV.
-10year no burn in guarantee. These QLED's are not susceptible to burn-in like other TV's. Great for not retaining that ESPN or CNN logo.
-QLED's produce incredibly bright, vibrant and diverse colors.
-Price - Generally you can find a QLED somewhat cheaper than an OLED

- **QLED :**

-Light is emitted on a pixel-by-pixel basis, so complete black can be right next to bright white with neither impacting each other. This gives you deep blacks and amazing contrast.
-No light bleeding because there's no back light. Each diode can operate individually without effect the others because they light up themselves.
-OLED's tend to be lighter and slimmer than a typical LED panel.
-Significantly wider viewing angles. Great for bigger spaces. Don't worry about sitting directly in front of these TV's.

Applications of QLED and OLED Display Technology

- In TVs
- Cellphone screens
- Computer screens
- Keyboards
- Lights
- Portable device displays

Conclusion

Though the structure of QLED is quite similar to OLED, you can easily tell the difference between the two by checking its light emitting centers which is made of cadmium selenide nanocrystals or simply called quantum dots. QLEDS are known for having less manufacturing costs and lower power consumption. QLED's manufacturers claim that QLED TVs are more power efficient than OLEDS with same color purity. When OLED hit the market, it was the absolute, most perfect TV technology ever. QLED, as an improvement over OLED, significantly improves the picture quality.QLED can produce an even wider range of colors than OLED, which says something about this new tech. QLED is also known to produce up to 40percent higher luminance efficiency than OLED technology. Further,many tests conclude that QLED is far more efficient in terms of power consumption than its predecessor, OLED. It's really tough to choose one from OLED and QLED, as both are the most popular and dominant display technologies out there. Each has its own set of advantages in terms of picture quality,contrast, and color correction. That being said, if you are looking for a high-definition television for a much brighter room or something that gives consistent dynamic quality from HDR, then QLEDs are the best choice.

-VANITHA J
II Year

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