

## **Sree Narayana College, Sivagiri, Varkala**

**P G Department of Chemistry**

**DBT Star College Scheme Supported**

**Organic Light Emitting Diodes- Fundamentals and Applications by Dr Sujith S S**, Research & Development Engineer, Raystar Optronics, Taiwan on 31<sup>st</sup> October 2020

The meeting started with the welcome address by Head of the department Dr Joly A. In her welcome address, ma'am expressed her contentment in welcoming everyone to the webinar specially our Chief Guest and alumni, Dr Sujith S S. Principal, Dr K C Preetha, inaugurated the function and spoke about the importance of Organic light emitting diodes in the present world.

Dr Sujith S S, alumni of our college, expressed his great pleasure being able to interact with our students. In the technical session, he explained the basics of OLEDs, the methods of preparation and the research being carried out in the same field. He could motivate our students and also explained about the various competitive exams to qualify and also the wide range of opportunities available for the them after they complete the course successfully.

Organic light emitting diodes (OLED) are widely used for the lighting and display applications. OLEDs possesses improved image quality - better contrast, higher brightness, fuller viewing angle, a wider color range and much faster refresh rates Thermal evaporation and solution process are utilizing for the fabrication of OLEDs. OLEDs are mainly classified into passive matrix OLEDs (PMOLEDs), active-matrix OLEDs (AMOLEDs), transparent OLEDs, top emitting OLEDs, white OLEDs, etc. Long time operational stability is one of the drawbacks of OLEDs. Utilization of potential materials, unique device architecture, and effective encapsulation technologies can improve the lifetime of OLED.

## Glimpses from the webinar conducted on OLED- Fundamentals and Applications

**Solution Process**

**Spin Coating**

Solution application onto the substrate → Rotation of the spin rotor → Solvent evaporation → Repeat the same → Multiple layered substrate

**Inkjet Printing**

Hydrophobic pixel pattern banks → Red emitter solution → Green emitter solution → Blue emitter solution

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 Certificate for  
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 People (86)  
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 Sujith Sudheendran  
 Renjith S  
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 Akhila S A  
 Ambily Chandran  
 Amina Seheed  
 Show all

Solution process for the preparation of OLEDs

**Thermal Evaporation vs Solution Process**

Process	Dry process (Vacuum evaporation)
Patterning	Shadow mask
Structure	Complex layer structure (5-6) → Complex process
Material	Separated function
Issue	Layer structure complexity Difficulty in mask patterning

**Solution Process**

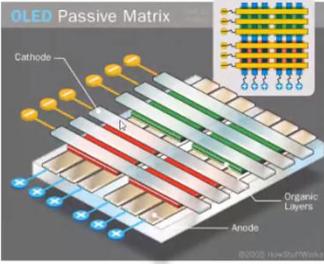
- Large area fabrication
- Low cost
- High material consumption rate
- Poor lifetime

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Comparison of thermal evaporation process and solution process in the preparation of OLEDs

Sujith Sudheendran is presenting

### Passive-matrix OLED



- PMOLEDs have strips of cathode, organic layers and strips of anode.
- The anode strips are arranged perpendicular to the cathode strips.
- The intersections of the cathode and anode make up the pixels where light is emitted.
- Easy to make
- More power consumption

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Sujith Sudheendran is presenting

Joly Aravind

preetha k c

Sujith Sudheendran

Renjith S

### Passive-matrix OLED (PMOLED)

PMOLEDs have strips of cathode, organic layers and strips of anode. The anode strips are arranged perpendicular to the cathode strips. The intersections of the cathode and anode make up the **pixels** where light is emitted. External circuitry applies current to selected strips of anode and cathode, determining which pixels get turned on and which pixels remain off. Again, the brightness of each pixel is proportional to the amount of applied current.

Sujith Sudheendran is presenting

### Passive-matrix OLED



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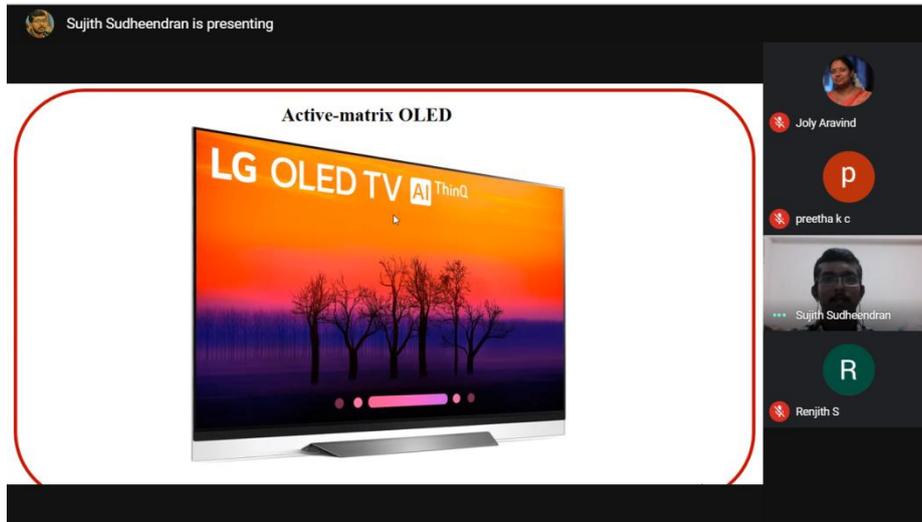
Sujith Sudheendran is presenting

Joly Aravind

preetha k c

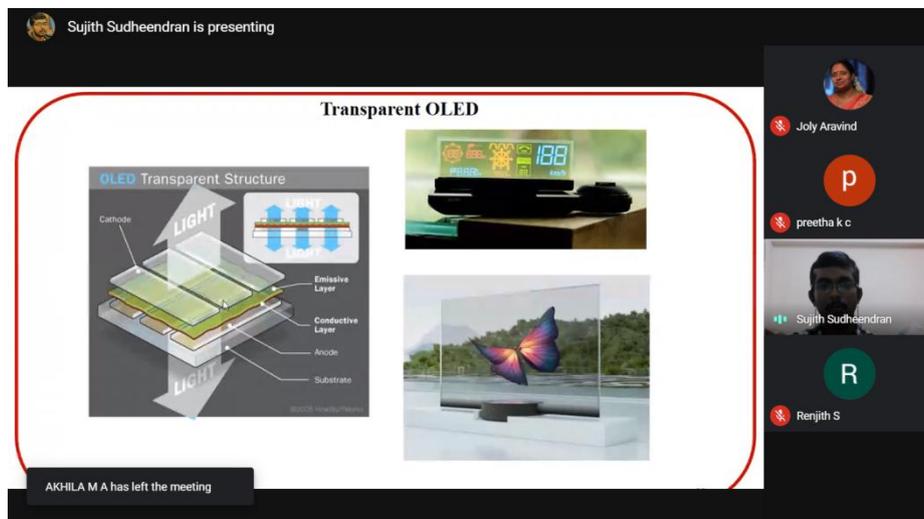
Sujith Sudheendran

Renjith S



### Active-matrix OLED (AMOLED)

AMOLEDs have full layers of cathode, organic molecules and anode, but the anode layer overlays a thin film transistor (TFT) array that forms a matrix. The TFT array itself is the circuitry that determines which pixels get turned on to form an image.



Transparent OLEDs have only transparent components (substrate, cathode and anode) and, when turned off, are up to 85 percent as transparent as their substrate. When a transparent OLED display is turned on, it allows light to pass in both directions. A transparent OLED display can be either active- or passive-matrix. This technology can be used for heads-up displays.

Sujith Sudheendran is presenting

### Top-emitting OLED

The diagram illustrates the structure of a top-emitting OLED. It consists of a substrate at the bottom, followed by an anode, a conductive layer, an emissive layer, and a cathode on top. Light is shown emitting from the top surface of the emissive layer. Labels include: Cathode, Emissive Layer, Conductive Layer, Anode, and Substrate. A small inset shows a simplified cross-section with 'LIGHT' arrows pointing upwards.

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Participants: Joly Aravind, preetha k c, Sujith Sudheendran, Renjith S

## Top-emitting OLED

Top-emitting OLEDs have a substrate that is either opaque or reflective. They are best suited to active-matrix design. Manufacturers may use top-emitting OLED displays in smart cards.

Sujith Sudheendran is presenting

### Advantages of Candlelight OLED

Light source	Spectrum	Free of				
		Hg	Flicker-ing	Glare	UV	IR
5,953 K 76 CRI	LED bulb	yes	yes	no	no	yes
5,363 K 85 CRI	Compact fluorescent lamp	no	no	no	no	yes
2,250 K 100 CRI	Incandescent bulb	yes	yes	no	yes	no
1,914 K 83 CRI	Candle	yes	no	no	yes	no
	Candle light-style OLED	yes	yes	yes	yes	yes

Renjith S has left the meeting

International webinar- OLED : Funda... ^

Participants: Joly Aravind, preetha k c, Sujith Sudheendran, Sreelekshmi Sreyas

Turn on captions

Sujith Sudheendran is presenting

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### Sunlight Style OLED

The slide illustrates the 'Sunlight Style OLED' concept. On the left, a graph plots Color Temperature (K) from 2000 to 8000 against the day cycle (Sunrise, Noon, Sunset). Curves show 'In morning, outdoor light' (peaking at ~6500K), 'In evening, 4K' (peaking at ~4000K), and '2500-3000K' (peaking at ~2500K). A 'daylight locus' is also shown. On the right, a timeline from 1950 to 2000 shows the evolution of lighting technologies: incandescent bulb (2700K, 1879), mercury lamp (3750K, 1925), fluorescent tube (4000K, 1938), fluorescent tube (warm) (3000K, 1981), and Sunlight-style color-temperature-tunable OLED (2000+). A vertical bar on the right shows voltage levels for various LEDs: 3.0V, 3.5V, 4.0V, 5.0V, 5.5V, 6.0V, 7.0V, and 8.0V.

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People (100) Chat

Sabitha B S 10:32  
Sabitha B S  
Second year  
Bsc physics  
SN college varkala

Sreelekshmi Sreyas 10:35  
Sreelekshmi S S  
S3 Physics

Akarsh Pakalkuri 10:35  
Akarsh p  
Bsc physics

Vidya PB 10:36  
Vidya PB  
Pg physics

Anjana AR 10:36  
Anjana AR  
MSc Physics

Send a message to everyone

Sujith Sudheendran is presenting

### Moisture attack

❖ Moisture may react with electrodes or organic materials in the device

Cathode (reduction) :  $2 \text{H}_2\text{O}(l) + 2e^- \rightarrow \text{H}_2(g) + 2 \text{OH}^-(aq)$   
 Anode (oxidation) :  $4 \text{OH}^-(aq) \rightarrow \text{O}_2(g) + 2 \text{H}_2\text{O}(l) + 4e^-$   
 Total reaction :  $2 \text{H}_2\text{O}(l) \rightarrow 2 \text{H}_2(g) + \text{O}_2(g)$

❖ Presence of pinholes can increase the moisture attack and degradation

❖ Decrease in EL intensity

❖ Change in electronic structure of organic layers

❖ Corrosion of cathode

The diagram shows a cross-section of an OLED device with layers: ITO, organic, Al spike, and Al. A 'pin hole' is shown where  $\text{O}_2$  and  $\text{H}_2\text{O}$  enter the device.

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International webinar- OLED : Fun... X

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Vidya PB  
Pg physics

Anjana AR 10:36  
Anjana AR  
MSc Physics

Send a message to everyone

The webinar was concluded with a Vote of thanks proposed by Ms Reshmi Jaya Raveendran, Coordinator and Assistant Professor of Chemistry, S N College, Varkala. Link for the feedback form was shared with the participants. E-certificates were issued to participants.



**SREE NARAYANA COLLEGE VARKALA**

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APCC No. 2002/2003/2004



<https://meet.google.com/ajx-szxa-aaa>

DIREKTAR SCHEME SUPPORTED

International Webinar on

# ORGANIC LIGHT EMITTING DIODES FUNDAMENTALS AND APPLICATIONS

By  
Dr. Sujith S S  
Research and Development Engineer  
Raystar Optronics Inc,  
Taichung, Taiwan

Organized by Department of Chemistry  
In association with IQAC

On Saturday, 31<sup>st</sup> October 2020  
10:00 AM to 12:00 PM

## ABOUT US

Located at Sivagiri, Varkala, the Sree Narayana College was established in 1964. It is one of the Pioneer Institutions in Kerala affiliated to University of Kerala, which provides Research, Post Graduate and Under Graduate programs. The Department of Chemistry has contributed to the world of Chemistry with lots of personnel working / pursuing their career in Chemistry at different parts of the world.

Last Date of Registration : 30 Oct 2020  
Fees and e-certificates will be issued.

For Registration  
<https://forms.gle/9pna3AZDpseC11ag6>

## PROGRAM SCHEDULE

Welcome	Dr. Joly A (HOD, PG Dept of Chemistry)
Inaugural Address	Dr. K C Preetha, (Principal, SN College Varkala)
Felicitation	Shri Aji S R M (Executive Member, SN Trusts) Dr Soju S (IQAC Coordinator)
Introduction	Smt. Induja P (Asst Professor of Chemistry)
Resource Person	Dr. Sujith S S, Research and Development Engineer Raystar Optronics Inc, Taichung, Taiwan
Vote of Thanks	Smt. Reshmi Jaya Raveendran, (Coordinator, Asst Professor of Chemistry)

Join through Google meet

<https://meet.google.com/ajx-szxa-aaa>

Join WhatsApp group

<https://chat.whatsapp.com/JTMxCF9HPZZSYgVFKjZE>



## ORGANIZING COMMITTEE

- Patron : Sri VELLAPALLY NAIKESAN (Manager, SN College)
- Dr. K C Preetha (Principal)
- Dr. A Joly (Head, Dept of Chemistry)
- Smt. Reshmi Jaya Raveendran (Coordinator)

## Organizing Committee Members

- Smt. Liji P Lakshmanan
- Smt. Archalatha A
- Smt. Shilitha Thampi K S
- Smt. Induja P
- Smt. Saritha S J
- Smt. Reshmi R
- Smt. Lakshmi S Dhanan
- Dr. Anshly Chandran