

# Organic Semiconductors and Optoelectronic Device Applications

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# Outline

## ■ Organic Semiconductors and Applications

@ *What?*

@ *Why?*

@ *How?*

## ■ Optoelectronic Device Applications

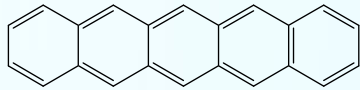
@ *What?*

@ *Why?*

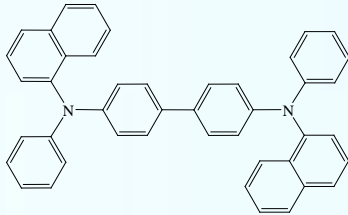
@ *How?*



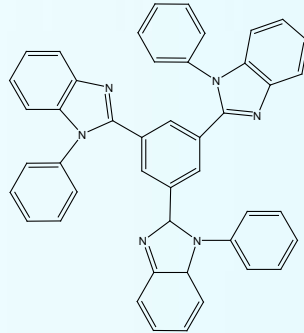
# What is Organic Semiconductors?



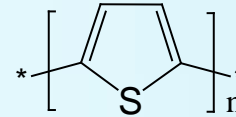
pentacene



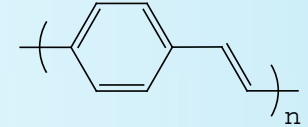
NPB



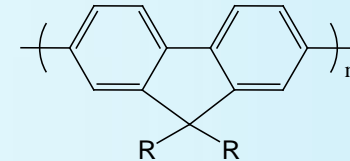
TPBI



Polythiophene



PPV



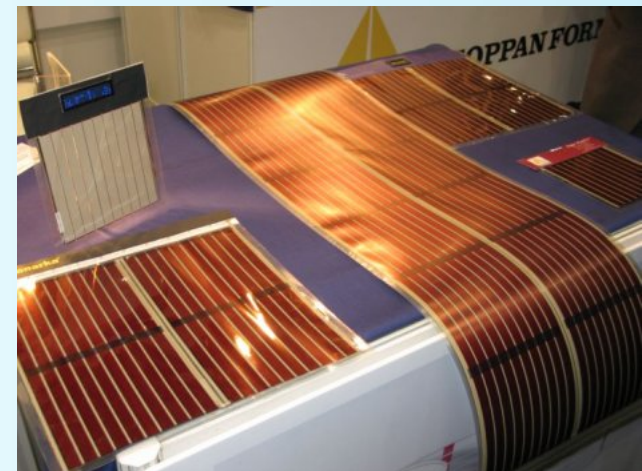
Polyfluorene

- Studied from 1960 (1948-first inorganic transistor, 1960-first MOS)
- Conjugated system : delocalization of  $\pi$  electrons
- Semiconductor properties
- Small molecules / polymer based
- Van der Waals bonded



# Why Organic Materials?

- Flexible
- Lightweight
- Large-area
- Low cost
- Low temperature processing
- Easy to form nano structure
- Versatile
- Environmental friendly



# OLED in Display

**Sony OLED TV QHD960x540 (2007)**



**Sony Flexible OLED (2009)**



**SDI 3.1" AMOLED in mobile phone (2009)**



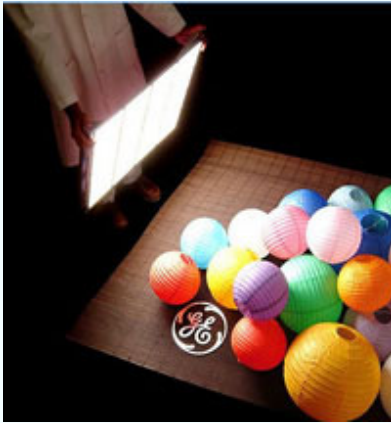
**SMD Transparent OLED on NB (2010)**



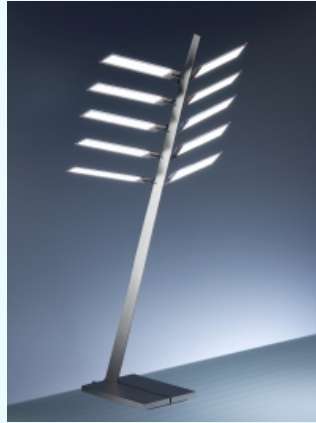


# OLED in Lighting

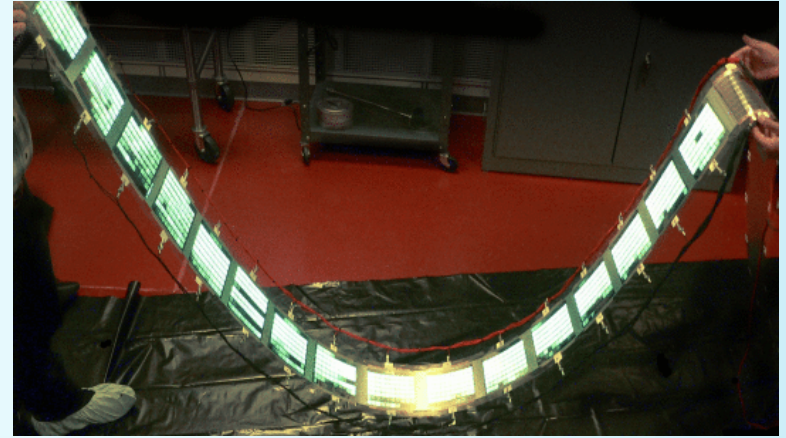
**GE (2007)**



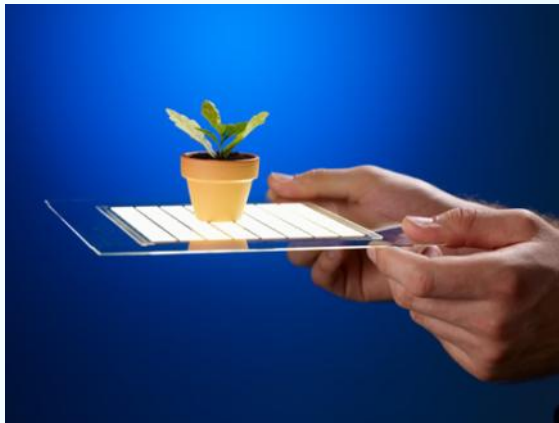
**OSRAM (2008)**



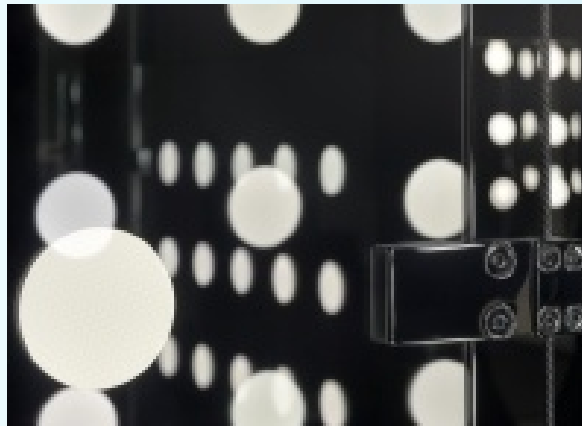
**GE roll-to-roll OLED Lighting(2008)**



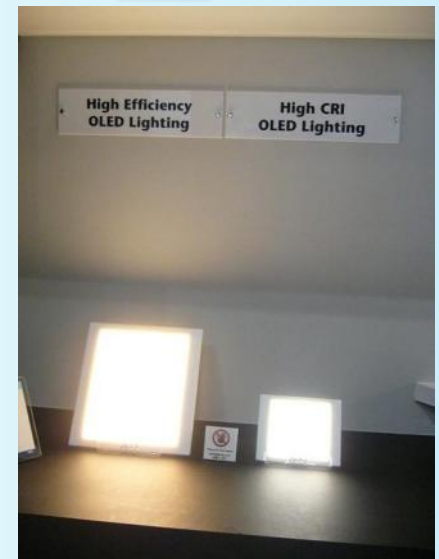
**Novaled (2009)**



**OSRAM (2010)**



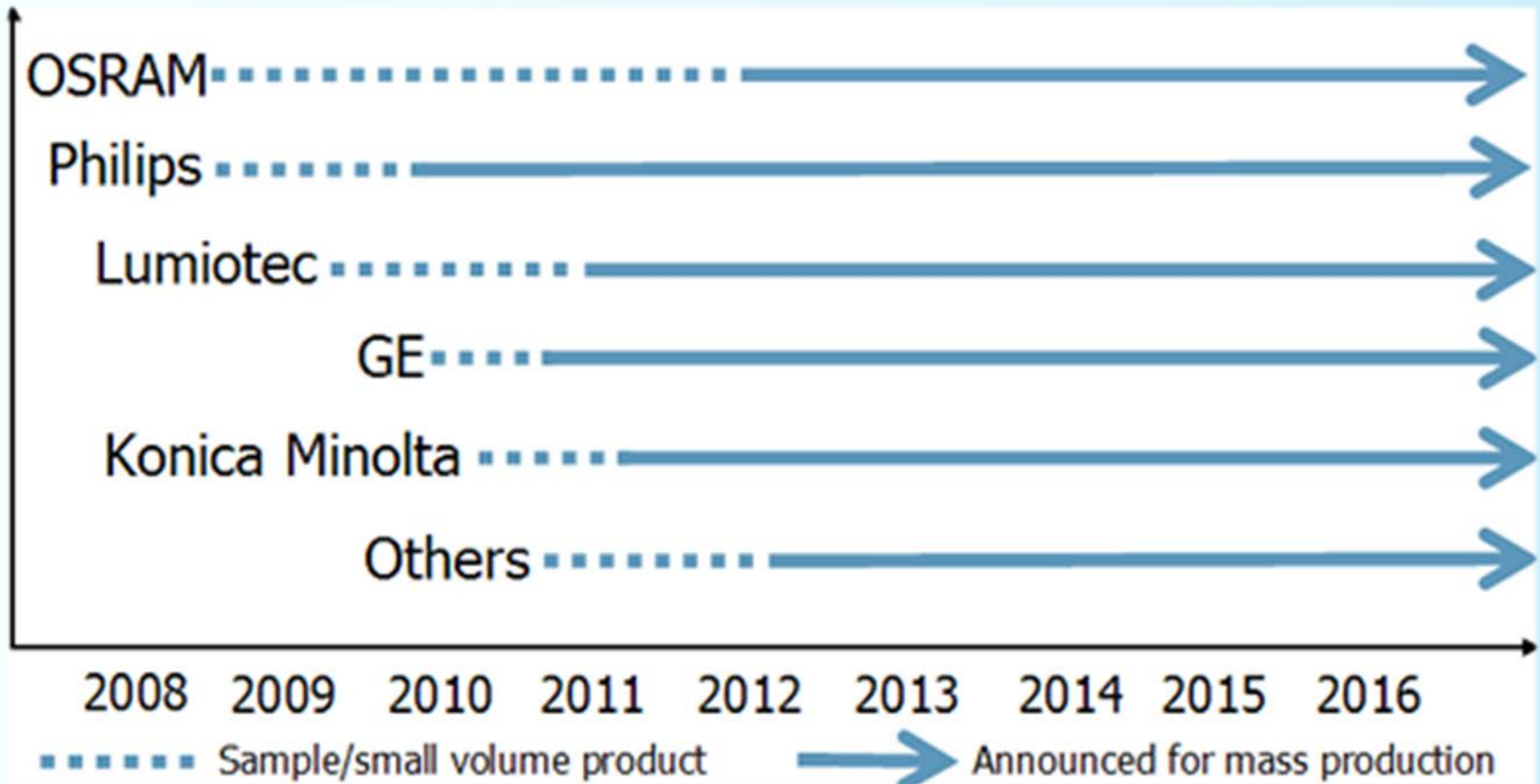
**AUO (2010)**



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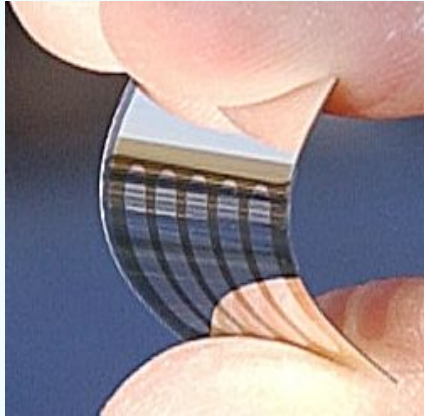
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# Roadmap of OLED in Lighting



# Solar Cells

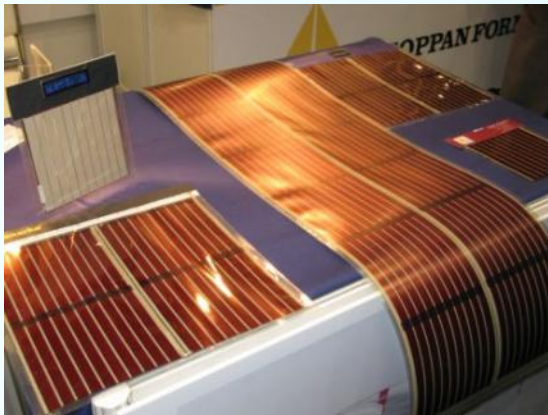
**GeorgiaTech flexible solar cell (2004)**



**AIST thin-film solar cell (2008)**



**Konarka roll-to-roll solar cell (2009)**

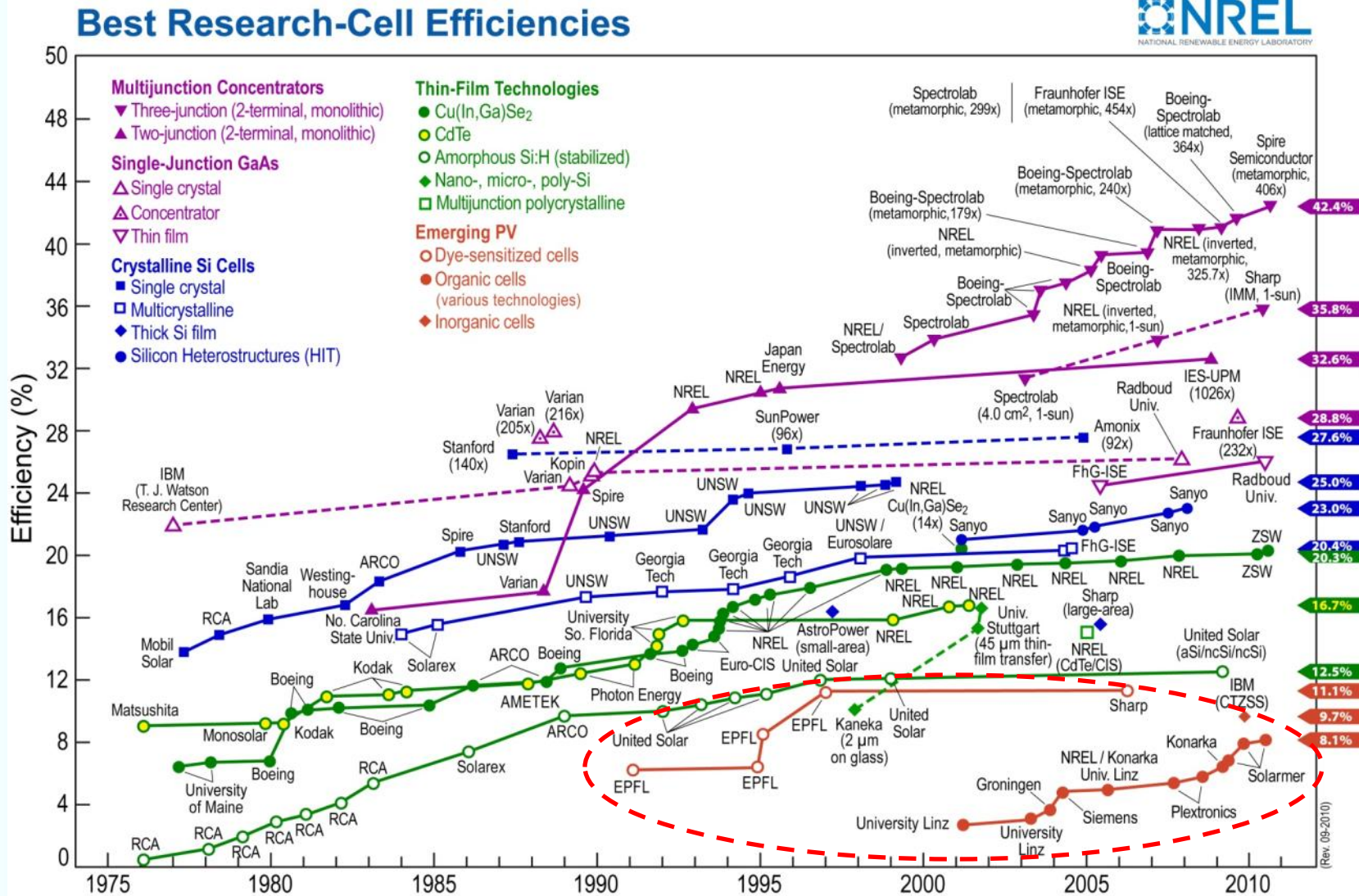


**Konarka portable solar cell bag (2009)**





# Record of Solar Cell



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From : NREL (2010)

# From Components to Applications

## ■ Basic optical components

Ⓜ Lens

Ⓜ Color filter

## ■ Basic optoelectronic devices

Ⓜ LED

Ⓜ Optical sensor

## ■ Integration of optical components and optoelectronic devices

Ⓜ Display

Ⓜ Camera

Ⓜ Light sensing system

Ⓜ Projector



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