OLED Lighting
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Innovative Simplicity
“There is something about that light.”
### Global View: OLED light engines

<table>
<thead>
<tr>
<th></th>
<th>OLEDWorks</th>
<th>Osram</th>
<th>Kaneka</th>
<th>Konica Minolta</th>
<th>LG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficiency lm/W</strong></td>
<td>60</td>
<td>40 (70)</td>
<td>50</td>
<td>45</td>
<td>60 (80)</td>
</tr>
<tr>
<td><strong>L70 Khrs</strong></td>
<td>10 @ 9000nits</td>
<td>10 @ 2000nits (20@3000nits)</td>
<td>30 @ 3000nits</td>
<td>8 @ 1000nits</td>
<td>40 @ 3000nits</td>
</tr>
<tr>
<td><strong>CRI</strong></td>
<td>&gt;90</td>
<td>&gt;75</td>
<td>&gt;80</td>
<td>&gt;75</td>
<td>&gt;90</td>
</tr>
<tr>
<td><strong>High brightness</strong></td>
<td>Transportation</td>
<td>Architectural</td>
<td>Flexible</td>
<td>Broad Portfolio</td>
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</tbody>
</table>

- Are OLED lighting panels positioned for market adoption?
  - Yes, surpass threshold for many applications
OLED: Naturally diffuse area light

- OLED is Organic Light Emitting Diode, a solid-state lighting technology
  - Easily dimmable and compatible with LED control systems
- OLED is made of very thin carbon based layers that create a naturally diffuse, broad spectrum, area light source.
- Designers are encouraged to break the paradigm of traditional lighting
  - Shades, diffusers, reflectors are not needed
  - OLED lighting can be a direct view experience

~1mm
Challenges: Technical

- OLED is inherently a planar device
- Current driven, light is emitted when holes and electrons combine
- Composed of carbon based (organic) molecules
- Active layers less than 1 micron thick
- Total device thickness ~2mm
- Light gets trapped!!
- Extensible to large format and flexible substrate
Challenges: Technical

- Larger scale efficient OLEDs at low cost
  - Efficiency: Getting the light out
  - Scale: Uniformity
  - Cost: Yield

- Drivers
  - Very low current requirements pose efficiency challenges

- Integration: Finishing & Handling
  - Into fixtures and into buildings
    - Controls, series/parallel, integration architectures
  - Light elements as building tiles
What do people love about OLED lighting?
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- Thin Planar Light Source
- Naturally diffuse
- Excellent Color rendering
- Low Glare
- Cool to the Touch
- Solid-State Efficient and Controllable
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It is the experience. The light quality is beautiful.
Challenges: Design

Aerelight.com

Visalighting.com

Omled.com
New Design Perspective, New Applications

- Bring light closer to the user and where light is needed
- Direct mounting on surfaces – akin to a building material
- Diffuse lighting for machine vision
- A better light experience:
  - General lighting: commercial and residential
  - Hospitality and retail
  - Museums
- A healthier light experience:
  - Wellness – seniors, patient rooms, recovery, etc
- A “lighter” light experience
  - Transportation
  - Furniture
- Flexible
Challenges: Design

Learning from CFL

2013: After 6 years on the market, LEDs have reached a market share of over 4%

... thanks to new lamp standards, greater awareness of efficient lighting choices, a greater number of utility programs promoting them — and leadership and investments from the DOE SSL program.

More efficient and lower cost not enough for market adoption if lighting is a bad experience

Challenges: Design

LED: Point source

OLED: Area source
Challenges: Design

- OLED can build on LED, solid-state lighting, expertise including drivers and controls
  - But far simpler assembly
- Blurs the line between light engine and fixture

The OLED Way

Fixture Design

Channel

OLED Coalition Workshop May 17, 2016
Challenges: Cost

OLED Cost Reduction

![Graph showing OLED Panel Cost Scenario](image-url)
Affordability

- Consider total cost
  - No need for heat sinks, optics, etc.
  - Can bring light closer to user, efficient use of light in many applications
  - Many applications don’t need very high lumen output with focused beams
    - It is not all about $/klm
  - Faster product development cycle

- Many fixtures now very cost competitive
New Design Perspective, New applications

Get ready for a superb lighting experience.