OLEDWorks

- 2010: OLEDWorks LLC founded in Rochester, NY, by Kodak OLED pioneers
- 2011-2014: Class A equity raise and build-up of production facility
- 2015: Acquired key assets of Philips OLED lighting business, including Lumiblade product line, manufacturing facility, patents and talent
- 2016: Announcement of Lumiblade Brite2 and Keuka module at L+B

Over 400 years of OLED expertise supporting your OLED experience
OLEDWorks capabilities

- Commercial products
  - High brightness white – square and rectangular
  - Amber
  - Modules with integrated driver

- Manufacturing in Aachen with worldwide biggest installed capacity for OLED Lighting
  - Incl. thin film encapsulation technology

- Significant R&D capabilities

- Joint Development
  - Corning – Willow® Glass for application in bendable OLEDs
What do people love about OLED lighting?

- Naturally diffuse
- Thin planar light source, rigid & flexible
- Excellent color rendering
- Solid-State efficient and controllable
- Cool to the Touch
- Low glare

It is the experience. The light quality is beautiful.
Robust Products

Frit sealing

- 0.7 mm glass
- ~ 0 mm stack
- ~ 1 mm cavity + lid

Thin film encapsulation*

- 0.7 mm glass
- ~ 0 mm stack
- < 0.1 mm TFE

0.7 mm glass

60°C / 90% RH

- 4000h
- 10000h

*depending on concept

Dr. Jörg Knipping
OLEDWorks proprietary
NMWP.NRW / Universität Siegen
Commercialized products in the last 3 years Lumiblade…

...tripled the efficacy
…tripled the luminance
…tripled the lifetime

By dividing the price by three!!!

2013: GL350 1st Gen
→ 16lm/W, 120lm max, 15khrs, 150-180€

2015: FL300
→ 47lm/W, 300lm max, 45khrs (@120lm), 50-60€
Boost performance

- ≈1.3x efficiency gain → efficacy, lifetime, junction temperature
- Spectral dependence of enhancement factor

<table>
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<th>Device</th>
<th>cathode</th>
<th>CRI</th>
<th>CCT</th>
<th>lm/W</th>
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<td>&gt;90</td>
<td>~3000</td>
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<td>IEL</td>
<td>Al</td>
<td>&gt;90</td>
<td>~3000</td>
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</table>

- Further gains in efficacy (>100 lm/W)
- Extension of lifetime (>50,000 hr at high brightness)

Excellent CRI and R9

3,000 cd/m²
Technical performance today

New product range 2016 (Brite 2 FL300 ww)

up to 62 lm/W
up to 300lm / 8,300 cd/m² brightness
up to 50,000 hours lifetime @100lm / 10,000 hours @300lm
CRI > 90
CCT 3000K and 4000K

5.2 W @300lm / 2W @100lm
Applications

More examples at www.oledworks.com/solutions/
Flexibility unlocks additional value

“If you need a thin design with a curve, instead of a gap and diffusing media, OLED is inherently better”
- Leslie North, Aurora Lighting

“Luminaire design is important. Future applications depend on how creative luminaires get”
- Amy Laughead-Riese, President and Principal Lighting Designer, 37 Volts Studio
Summary

- OLEDs left R&D stage to become readily available commercial products for functional lighting
  - Continued improvements in light quality and efficacy enable ever more applications for rigid panels
  - Flexibility unlocks additional value for OLED lighting
  - Cost-down remains a key topic

With thanks to all colleagues at OLEDWorks and Corning who contributed to the results shown here
THANK YOU

OLEDWorks LLC

Design Freely
Organic Light Emitting Diodes