OLED Manufacture Challenge: Strategy for Cost Reduction and Yield Improvement

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Trovalto Technology CO., Ltd
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a presentation for U.S. DOE Workshop
Contents

1. Introduction of Trovato Company
2. Cost Reduction and Yield Improvement
3. Marketing & Sale of OLED Lighting in China
4. Conclusion
Trovato Mfg., Inc (U.S. Manufacturer)

Trovato Tech. CO., Ltd. (China Sale & Service)

China Representative for U.S. companies:
- LC TECHNOLOGY SOLUTIONS INC: Gloveboxes
- MeiVac INC: Sputtering & E-Beam
- MCVAC MANUFACTURING CO. INC: QCM Components

More to come in the near future...

R&D Support in China

**Strategic Emerging Industries during the 12th Five-Year Plan**

- New Materials
- New-generation Information Technology
- High-end Equipment Manufacturing
- New-energy Cars
- Energy Saving and Environment Protection
- Biology

**The 12th Five-year Plan**

2011-2015

**Contribution of the Emerging Industries to the Overall GDP, China, 2010-2020**

- 2010: 4%
- 2015: 8%
- 2020: 16%

189.4 billion USD

National R&D investment is 1184.66 billion RMB in 2013, 15% annual growth rate

863, 973, NSF of China...
Trovato Systems in China

Market for Trovato systems grows rapidly in China
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Supply Chain

1. Substrate
2. Materials
3. Stack
4. Encapsulation
5. Equipment

Trovato OLED lab and Trovato system users may contribute to R&D for OLED lighting!
Low-Cost Substrate for OLED Lighting

Metal foils: thin metal foils of aluminum (Al) from Alcoa

Advantages:
1. Able to achieve DOE cost target, estimated $7/m² for OLED ready substrates;
2. Lightweight, durable, hermetic, and suitable for thermal management;
3. In roll-to-roll production, Al foils offer better physical dimension stability and handle stress better than polymeric substrates.

Top-emission architectures: low-cost substrate with planarizing polymer
Material development support for lower-cost OLED device fabrication

1. Dopant materials
2. Host Materials
3. Electron Transport Materials
Dr. Jian Li at ASU is focusing on efficient and stable White OLEDs using a single emitter, that will enable low cost fabrication by decreasing the complexity of device:

**Benefits:**
1. decreasing the complexity of device fabrication;
2. increasing the robustness of materials;
3. lowering the cost of equipment;

**Excimer-based white OLEDs:**
- ITO/HATCN (10 nm)/NPD (40 nm)/TAPC (10 nm)/14% Pt7O7:mCBP (25 nm)/DPPS (10 nm)/BmPyPB (40 nm)/LiF/Al.

**Adv. Mater. 2014, 26, 2931–2936**
Encapsulation Integrity for OLED lighting panel: sputtering single-layer hermetic seal (Corning)

Benefits:
1. Elimination of desiccants;
2. Improve device stability;
3. Lower fabrication cost;
Features of Trovato R&D tools:
1. Fully Automated Vacuum Control;
2. PC-Based Process Control;
3. 4 Material Co-Deposition;
4. <10 minutes to Process Pressure;
5. Ultra-High Resolution QCM Monitoring;
Equipment
Equipment

Gradient Deposition

NPB

Alq$_3$
Marketing & Sale of OLED Lighting in China

There are 1.4 billion people in China, and activity in China will help to leverage the fund for potential market of OLED lighting:

- **Eye-shielding Lamps for Children**
- **Shadowless Surgical Operating Lamp**
- **New Construction Design**
- **Artistic Lighting**
Conclusion

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1. Fully International Collaboration is Significantly Important;

2. Trovato Technology may help to lower the cost and improve fabrication yield;

3. China’s market will help OLED lighting panel improve marketing penetration;
Conclusion

Thanks for your attention!!!