

*iSuppli*

---

## **Next Phase of Volume Production Entails Challenges for OLED**

Emerging Display Technologies

OLED Market Tracker - H2 2007

**Next Phase of Volume Production Entails Challenges for OLED**

By Vinita Jakhanwal, Principal Analyst

Emerging Display Technologies – H2 2007

*Executive Summary* ..... 1

*Major Developments (Q2 2006 – Q3 2007)* ..... 1

*Market Forecast Overview* ..... 4

*Market Shares* ..... 6

*Introduction* ..... 8

*OLED Products* ..... 9

*Current Panel Products* ..... 9

*Active-Matrix Plans* ..... 13

*Market Forecast* ..... 15

*Changes from the H1 2007 Edition* ..... 15

*Forecast Assumptions* ..... 15

*Key Findings* ..... 17

*Market Shares* ..... 18

*Analysis by Drive Type* ..... 19

*Analysis by Application* ..... 23

*Mobile-Phone Subdisplays* ..... 23

*Mobile-Phone Main Displays* ..... 25

*Portable Media (MP3/MP4/PMP/DVD)* ..... 28

*Cameras and Camcorders* ..... 30

*Auto Displays* ..... 30

*Television* ..... 31

*OLED Lighting* ..... 32

*Manufacturing Capacity and Supply/Demand Balance* ..... 33

*Topics in Strategy* ..... 37

*OLED Intellectual Property* ..... 37

*Recommendations* ..... 39

*Appendix A: Broad View of the Major Technical Challenges for OLED* ..... 40

*Out-coupling Efficiency* ..... 43

*Shaped Substrate Techniques* ..... 43

*Microlens Arrays* ..... 43

*Micro-Cavities and Tandem OLEDs* ..... 44

*Two-dimensional Photo Crystal Structures* ..... 44

*Transparent OLEDs and flexible OLEDs* ..... 46

## Next Phase of Volume Production Entails Challenges for OLED

By Vinita Jakhanwal, Principal Analyst

Emerging Display Technologies – H2 2007

<i>Appendix B: Technical Background of OLED</i> .....	48
<i>Definitions and History</i> .....	48
<i>Materials</i> .....	50
<i>Devices – Structure and Manufacturing</i> .....	56
<i>Other Solution-processing Techniques</i> .....	60
<i>Appendix C: OLED Products: Development Timeline</i> .....	72
<i>Small Molecular PM OLED Products</i> .....	72
<i>Polymer PMOLED Products</i> .....	73
<i>Small Molecular OLED "Second Round"</i> .....	73
<i>AMOLED Demos and Products</i> .....	74
<i>OLED activities in China, India and Brazil</i> .....	78
<i>OLED Research in China</i> .....	78
<i>OLED Research in India</i> .....	80
<i>OLED Development in Brazil</i> .....	81
<i>Summary</i> .....	81
<i>About iSuppli Corporation</i> .....	82

### List of Figures

<i>Figure 1: Worldwide OLED Display Shipment Value by Application, 2005-2013</i> .....	5
<i>Figure 2: Worldwide OLED Display Unit Shipments by Application, 2005-2013</i> .....	5
<i>Figure 3: OLED Panel Manufacturer Unit Market Shares, 2006</i> .....	6
<i>Figure 4: OLED Panel Manufacturer Value Shares, 2006</i> .....	7
<i>Figure 5: OLED Panel Manufacturer Unit Market Shares, 2006</i> .....	18
<i>Figure 6: OLED Panel Manufacturer Value Market Shares, 2006</i> .....	19
<i>Figure 7: OLED Panel Market Value, Passive and Active Matrix, 2005-2013</i> .....	20
<i>Figure 8: OLED Panel Units, Passive and Active Matrix, 2005-2013</i> .....	20
<i>Figure 9: OLED Panel Value with Passive and Active Separated, 2005-2013</i> .....	22
<i>Figure 10: Power Consumption Usage Patterns for LCD and AMOLED in Mobile Phones</i> .....	26
<i>Figure 11: Mobile Handsets with Samsung SDI AMOLED Panels Launched Through Q3 2007</i> .....	27
<i>Figure 12: Portable Media Player Unit Shipments (OLED Panels and Total End Products), 2005-2013</i> .....	28

## Next Phase of Volume Production Entails Challenges for OLED

By Vinita Jakhanwal, Principal Analyst

Emerging Display Technologies — H2 2007

<i>Figure 13: Sony XEL-1 AMOLED (11-inch) TV</i> .....	31
<i>Figure 14: Transparent OLED Structure</i> .....	46
<i>Figure 15: Flexible OLED Display Demonstrations</i> .....	47
<i>Figure 16: Basic OLED Device Structure</i> .....	48
<i>Figure 17: Chemical Structure of Aluminum Quinolate (Alq3)</i> .....	51
<i>Figure 18: Chemical Structure of P-phenylenevinylenes (PPV)</i> .....	52
<i>Figure 19: OLED Material and Full-color Panel Lifetime Forecast</i> .....	55
<i>Figure 20: Basic OLED Process Flow: Left Side for Small Molecular, Right Side for Polymer</i> .....	56
<i>Figure 21: 3M and Samsung SDI's LITI Process</i> .....	59
<i>Figure 22: Schemes to Generate Full Color in OLED</i> .....	61
<i>Figure 23: Schematic of RIST Process</i> .....	62
<i>Figure 24: Transparent-Cathode Type (left) and Inverted Type (right) Top-Emitting Structures</i> .....	67
<i>Figure 25: Protective Metal Can Used by Pioneer</i> .....	68
<i>Figure 26: Thin-film Encapsulation</i> .....	68

### List of Tables

<i>Table 1: Panel Makers by Revenue and Units, 2006</i> .....	7
<i>Table 2: Current OLED Panel Products, Q307</i> .....	9
<i>Table 3: Plans by AMOLED Players</i> .....	14
<i>Table 4: OLED Applications</i> .....	17
<i>Table 5: AMOLED Units and Value by Application, 2005-2013</i> .....	21
<i>Table 6: PMOLED Units and Value by Application, 2005-2013</i> .....	23
<i>Table 7: Mobile Handset Subdisplay Units and Value, 2005-2013</i> .....	24
<i>Table 8: Mobile Handsets with OLED Main Displays</i> .....	25
<i>Table 9: Mobile Handset Main Display Units and Value, 2005-2013</i> .....	27
<i>Table 10: OLED Manufacturing Capacity, 2007</i> .....	34
<i>Table 11: Kodak and CDT Licensees</i> .....	38
<i>Table 12: Summary of Broad Technical Challenges Facing OLED Developers</i> .....	47
<i>Table 13: Comparison of Active-matrix OLED and Active-matrix LCD</i> .....	49
<i>Table 14: Comparison of PM OLED and PM LCD</i> .....	50
<i>Table 15: Comparison of Small Molecular and Polymer OLED</i> .....	52

**Next Phase of Volume Production Entails Challenges for OLED**

By Vinita Jakhanwal, Principal Analyst

Emerging Display Technologies – H2 2007

*Table 16: Best Reported Laboratory Lifetime of OLED Material and Full-color Panel Summary ..... 54*

*Table 17: Comparison of Top Emission and Bottom Emission OLED ..... 66*

*Table 18: Comparison of Encapsulation Technologies ..... 69*

*Table 19: Companies That Have Shown AMOLED Prototypes ..... 75*

*Table 20: Companies Committed to Manufacture AMOLED Display Module as of May 2007 ..... 75*

*Table 21: Companies Committed to AMOLED and Which Have Demonstrated Larger Than 10-inch AM OLED ..... 76*