ORGANIC AND FLEXIBLE ELECTRONICS IN GERMANY – A SNAPSHOT

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OUTLINE

- Organic & Large Area Electronics (OLAE) in Europe
- German funding policy in Organic Electronics
- The German research landscape
- The FRAUNHOFER-GESELLSCHAFT
  - FRAUNHOFER IPMS - Institute For Photonic Microsystems
  - COMEDD – Center for Organic Materials and Electronic Devices Dresden
- Organic Electronics Saxony
- Project example R2FLEX
- Summary
ORGANIC & LARGE AREA ELECTRONICS (OLAE)

Total market 2027: 330 billion US$

- OLED display: 20%
- OLED lighting: 14%
- Photovoltaic: 14%
- OLED panel: 11%
- Electrophoretic displays: 7%
- Others: 6%
- Logic / memory: 38%
OLAE AS A GREEN TECHNOLOGY

- OLAЕ is inherently green and applies to the principle of people, profit, planet.
  It is:
- Robust
  - Flexibility allows for ubiquitous electronics
- Low carbon print
  - Low material consumption, low impact manufacturing and substantial contribution to reducing energy consumption
- Low cost manufacturing
  - Achieving cost levels to substitute CMOS technology
- OLAЕ to allow further integration of IT and ET
OLAE ROADMAP

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Source: SEMI, WSTS, DisplaySearch, NanoMarkets,
OLAE SWOT FOR EUROPE

- Already in possession of materials and production machinery
- Huge European market

- Lack of start-ups and entrepreneurs with clear view from research to manufacturing
- Committed giants are needed

- Formidable research on OLEDs, printed RFIDs and transistors.
- Field of applications steadily growing

- European market will be taken over by foreign manufacturers
- External companies will benefit from the research and investment done in Europe

Source: Strategic Research Agenda Organic & Large Area Electronics
STRATEGIC RESEARCH AGENDAS - TOGETHER IN PHOTONICS & ORGANIC ELECTRONICS

- The new *Strategic Research Agenda of Photonics21* (European Technology Platform for photonics) and the first *Strategic Research Agenda of the Organic Large Area Electronis (OLAE)* were handed over to the European Commission during the Photonics21 Annual Meeting in Brussels, January 2010


OLAE KEY RECOMMENDATIONS FOR SRA IMPLEMENTATION

- Initiate clustered approach with pilot production centres to close the gap between R&D and products
- Nuture the emergence of a European OLAE industry, for example through new approaches to create lead markets
- Establish OLAE platform together with all stakeholders
- Coordinate existing OLAE networks and platforms
- Coordinate EU and national member state R&D programmes
- Develop an approach for R&D cooperation in and beyond Europe
- Take measures to early establish standards for new products
- Establish new training schemes, fit to the heterogeneous OLAE field
- Increase the EU R&D funding budget for OLAE in proportion to huge market expectations and establish new ways to access capital
GERMAN FUNDING ACTIVITIES IN ORGANIC ELECTRONICS (1/2)

Organic Electronics funding since 10 years by the German Federal Ministry of Education and Research, first in single projects, later in coordinated actions, like:

- Funding topic “Polymer Electronics”: since 2001, appr. 30 Mio € funding up to now
- Innovation Alliance OLED
  - Funding 120 Mio €, Start Phase I: 2006, Start Phase II: 2009
  - Innovation Alliance: Industry commits to invest a volume 5 times of the funding budget after the funding phase and successful project results
- Projects Phase I:
  - OPAL
  - R2Flex – see slides project example at the end of this talk
- Projects Phase II:
  - Lili
  - So-Light
  - Topas
GERMAN FUNDING ACTIVITIES IN ORGANIC ELECTRONICS (2/2)

- Innovation Alliance OPV
  - Funding 60 Mio €, Starting: 2008, 2nd phase intended to start 2011
  - Same conditions for Innovation Alliance OLED, here 240 Mio € + 60 Mio € during project phase
  - Several projects

- "Cluster of Excellence" Organic Electronics in Heidelberg
  - 40 Mio.€ funding, funding quote 50%, 2008-2013
  - Several projects

- Links to project websites available at:
  - [http://www.optischetechnologien.de/index.php?id=584](http://www.optischetechnologien.de/index.php?id=584)
THE GERMAN RESEARCH LANDSCAPE

Characteristics of Research

Applied Research

- Federal/ German Länder Institutes: 0.9
- HGF*: 2.4
- WGL*: 1.12
- Fraunhofer*: 1.4
- MPG*: 1.44
- AiF: ~0.25

Fundamental Research

- Universities: 9.2

Funding

- Industry (internal and external expenditures): 55.4

*overall budget in billion euros

HGF  Hermann von Helmholtz-Gemeinschaft
WGL  Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz
AiF  Arbeitsgemeinschaft industrieller Forschungsvereinigungen
MPG  Max-Planck-Gesellschaft

1 estimation Wissenschaftsstatistik 2008, Stifterverband
2 2007
3 2008

Source: Stifterverband für die Deutsche Wissenschaft, Destatis
FRAUNHOFER-GESELLSCHAFT

- Undertakes applied research of direct utility to private and public enterprise and of wide benefit to society
- 7 Groups:
  - Information and Communication Technology
  - Life Sciences
  - Microelectronics
  - Light & Surfaces
  - Production
  - Materials and Components - MATERIALS
  - Defense and Security
- Our Customers:
  - Industry
  - Service sector
  - Public administration
- 59 Institutes, 17 000 employees
- Non-profit organisation
  - ≈ 33 % basic funding by government
  - ≈ 33 % public funded projects
  - ≈ 33 % direct contracts by industry
Directors:
Prof. Dr. Hubert Lakner
Prof. Dr. Karl Leo

Figures 2009:
- Permanent staff: 207
- Scientific assistants: 26
- Operating budget: 23,3 Mio €
- Industrial commissions: 26 %
- Project revenues: 62 %
- Basic funding: 38 %

Business Units:
- Micro Scanner Devices
- Spatial Light Modulators
- Sensor and Actuator Systems
- Lifetronics
- Lighting and Photovoltaics
- OLED Microdisplays and Sensorics
CENTER FOR ORGANIC MATERIALS AND ELECTRONIC DEVICES DRESDEN

COMEDD as trademark of Fraunhofer IPMS

- Opened in 2008
- Investments of about 30 M€ (EU, Saxony, FhG)

Mission

- Customer and Application Specific Research, Development and Pilot fabrication on novel device concepts and manufacturing methods in the field of organic electronics (small molecule)

Infrastructure

- Clean room 900 m², Labs 100 m²

Fabrication lines

- Pilot line Gen2 (370 x 470 mm²)
- Pilot line OLED-on-CMOS (200x200 mm²)
- Roll-to-Roll line (300 mm foils)
COMEDD APPLICATIONS

- Signage
- OLED on CMOS
- Lighting
- Organic Photovoltaics
OES Value Chain

job market: already > 800 coworkers in Saxony!
PROJECT EXAMPLE R2FLEX
SETUP

- R2flex = Roll-to-roll fabrication of small molecule OLEDs for lighting applications and organic solar cells on flexible substrates
- 11 partners from industry and research
- Project volume: 10.7 Mio. € in total (58% funding by BMBF)
- Development Targets
  - Technology for flexible OLED and OSC
  - Development and installation of Roll-To-Roll Pilot Coater
  - Transfer of technologies from sheet-to sheet- to R2R pilot processing
  - monochrome OLEDs (signage)
  - white OLEDs (lighting)
  - organic solar cells
  - encapsulation
- www.r2flex.de
PROJECT EXAMPLE R2FLEX
RESULTS

- Roll-to-Roll line for small molecule OLED for lighting application under installation at COMEDD
- Batch type R&D vacuum coater for metal strips and polymer webs up to 300 mm with up to 14 linear organic evaporators
- First OLED processed in this R2R coater shown!
- Substrate patterning and coating by wet processes
- Lamination under inert atmosphere
- Inert transfer between the systems possible
SUMMARY

- Organic & Large Area Electronics (OLAE) in Europe
  - Clustered approach with pilot production centres to close the gap between R&D and products
  - Coordinate existing OLAE networks and platforms, EU and national member state R&D programmes
- Well focused German funding policy in Organic Electronics
- COMEDD – Center for Organic Materials and Electronic Devices Dresden
- Organic Electronics Saxony as one of the major clusters in Europe
- Project R2FLEX – First SM-OLED by R2R processing shown

  http://www.plastic-electronics2010.com/
Thank you for your attention!

COMEDD
We shape the light.