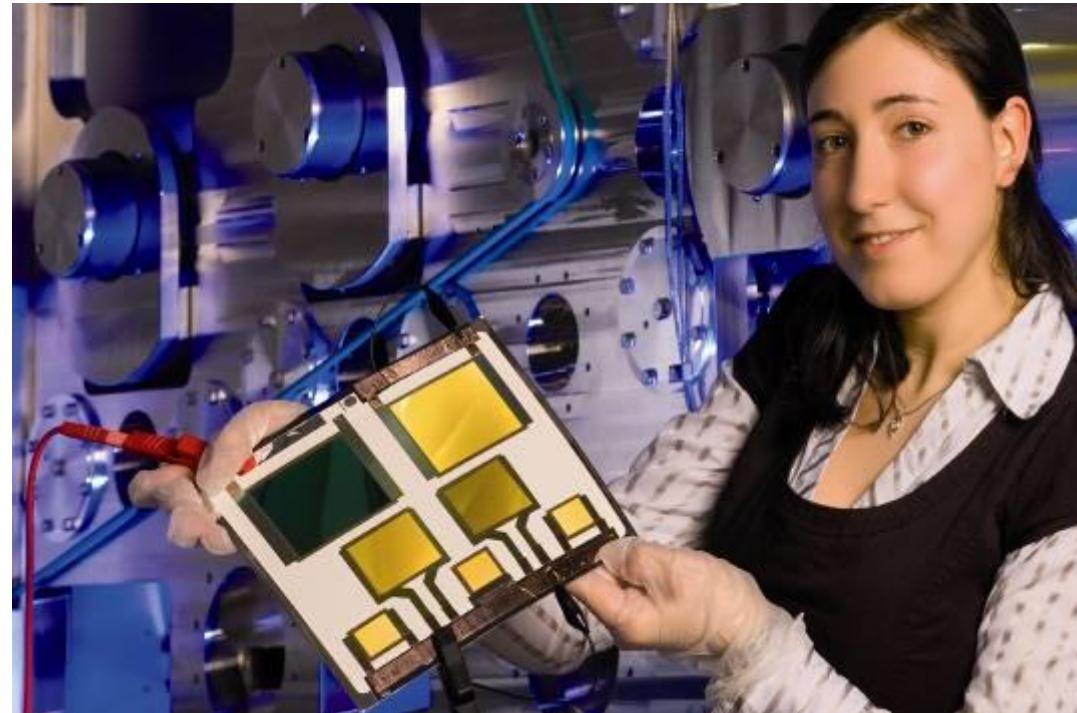

ORGANIC AND FLEXIBLE ELECTRONICS IN GERMANY – A SNAPSHOT

Dr. Christian May

Fraunhofer IPMS - Center for Organic Materials and Electronic Devices Dresden
COMEDD

National Academies
Symposium
“Flexible Electronics”

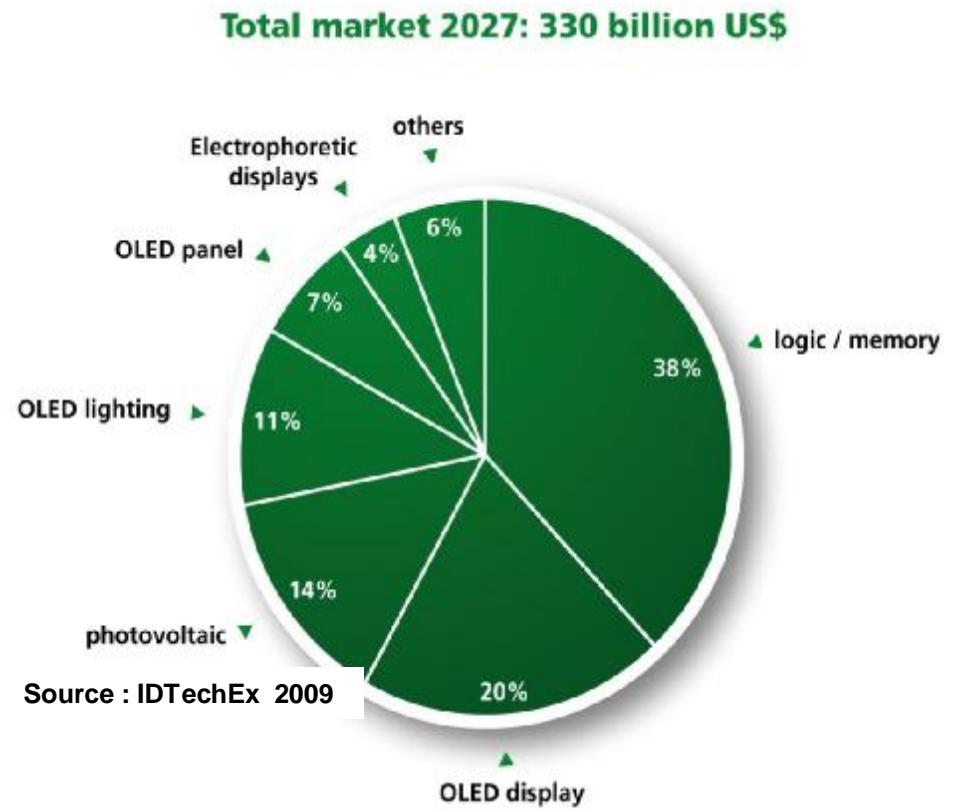
September 24, 2010
Washington DC



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

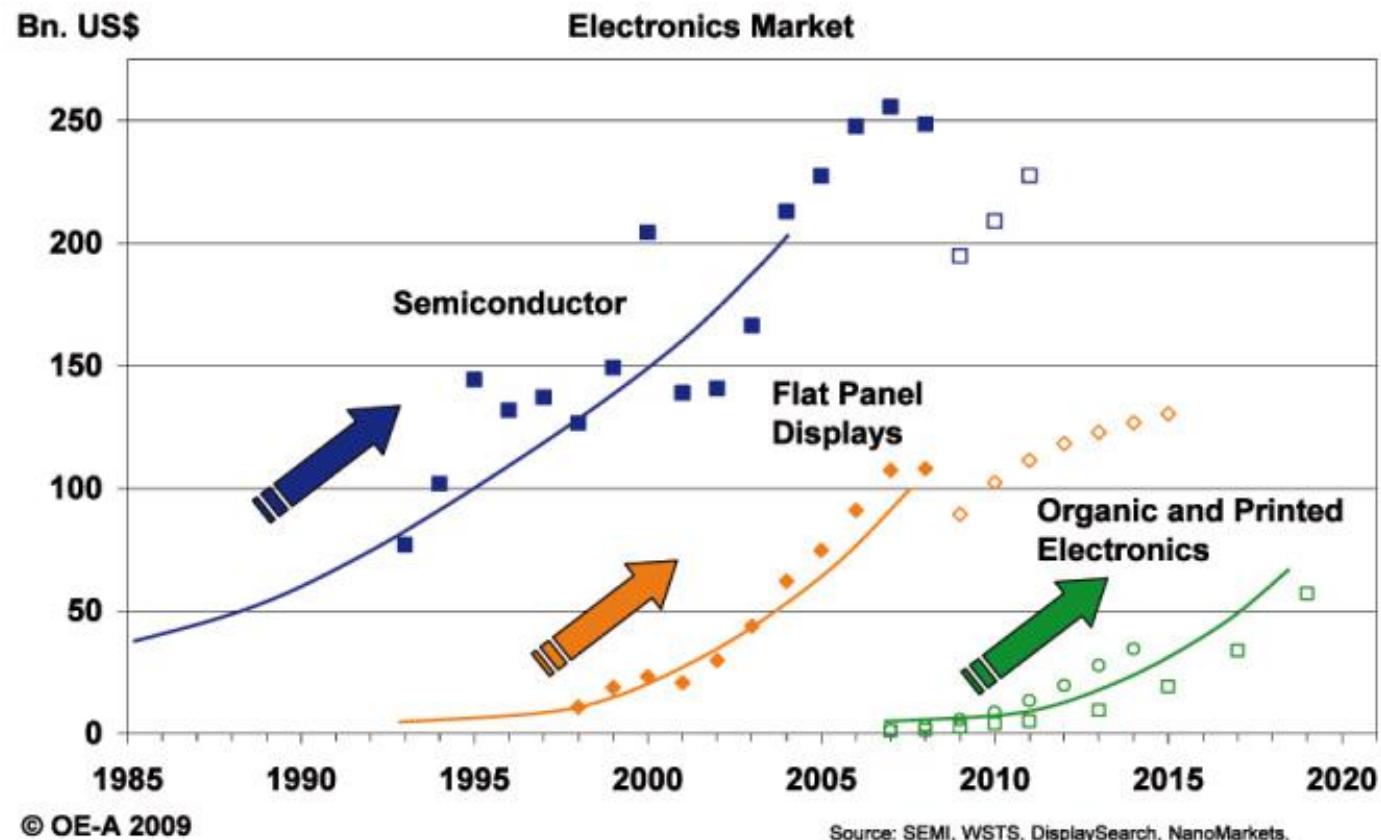
ORGANIC & LARGE AREA ELECTRONICS (OLAE)



OLAE AS A GREEN TECHNOLOGY

- OLAE 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
 - OLAE to allow further integration of IT and ET

OLAE ROADMAP



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 Electronics (OLAE)** were handed over to the European Commission during the Photonics21 Annual Meeting in Brussels, January 2010
- SRA Photonics 21 available at :
http://www.photonics21.org/download/SRA_2010.pdf
- SRA OEA available at :
http://www.photonics21.org/download/ola_e_sra.pdf



OLAE KEY RECOMMENDATIONS FOR SRA IMPLEMENTATION

- Initiate clustered approach with pilot production centres to close the gap between R&D and products
- Nurture 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)

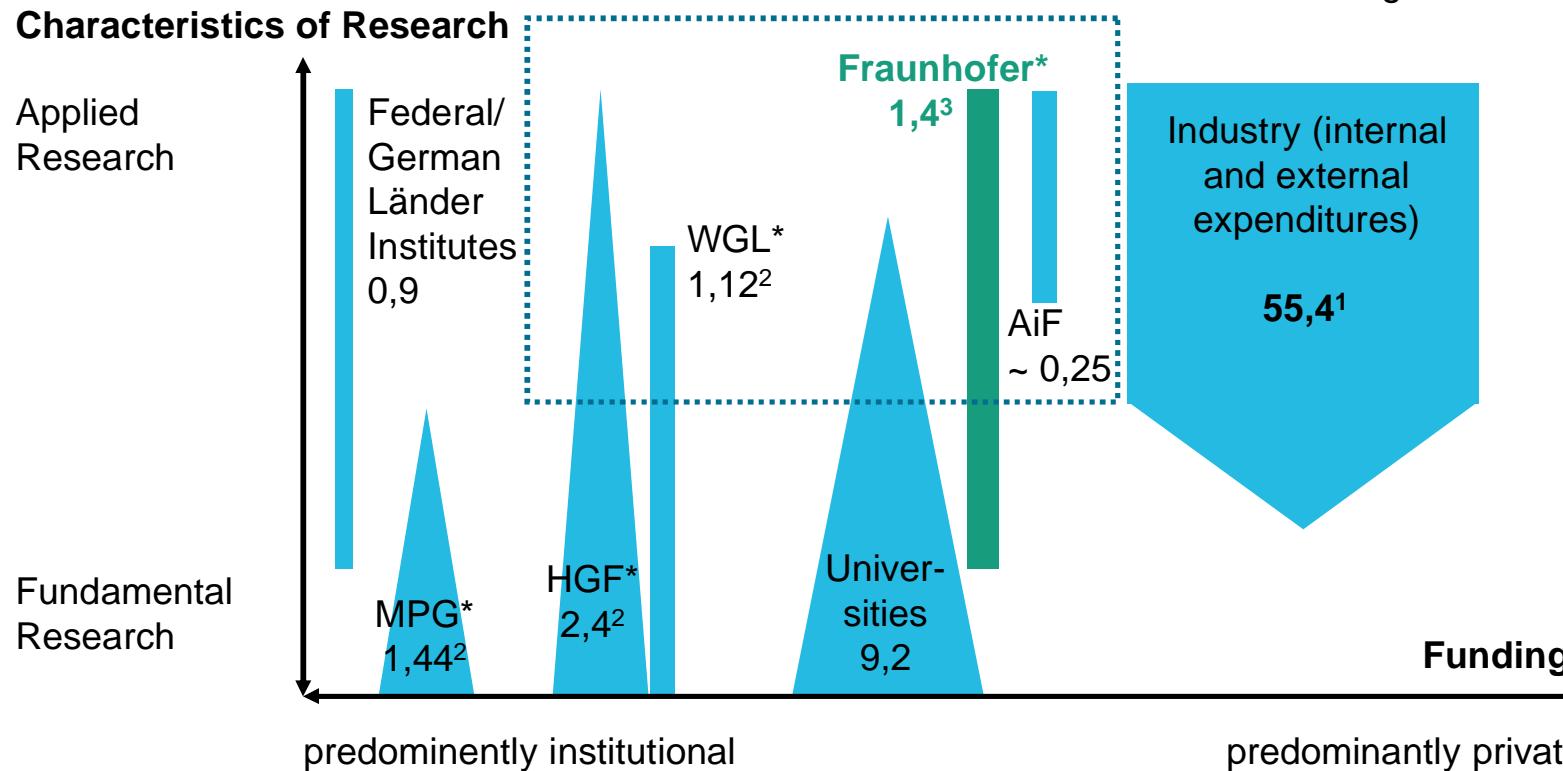
- Organic Electronics funding since 10 years by the German Federal Ministry of Education and Research, first in single projects, later in coordinated actions, like:
- Funding topic “Polymer Electronics”: since 2001, appr. 30 Mio € funding up to now
- Innovation Alliance OLED
 - Funding 120 Mio €, Start 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>

THE GERMAN RESEARCH LANDSCAPE

*overall budget in billion euros



HGF Hermann von Helmholtz-Gemeinschaft

WGL Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz

AiF Arbeitsgemeinschaft industrieller Forschungsvereinigungen

MPG Max-Planck-Gesellschaft

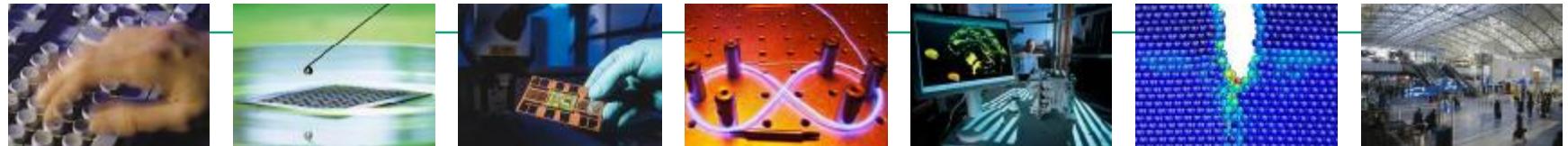
¹ estimation Wissenschaftsstatistik 2008, Stifterverband

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

▪ 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

▪ 7 Groups:

- Information and Communication Technology
- Life Sciences
- Microelectronics
- Light & Surfaces
- Production
- Materials and Components - MATERIALS
- Defense and Security

FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS - IPMS



n Directors:

Prof. Dr. Hubert Lakner
Prof. Dr. Karl Leo

n Figures 2009:

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

n Business Units:

- n Micro Scanner Devices
- n Spatial Light Modulators
- n Sensor and Actuator Systems
- n Liftronics
- n Lighting and Photovoltaics
- n 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

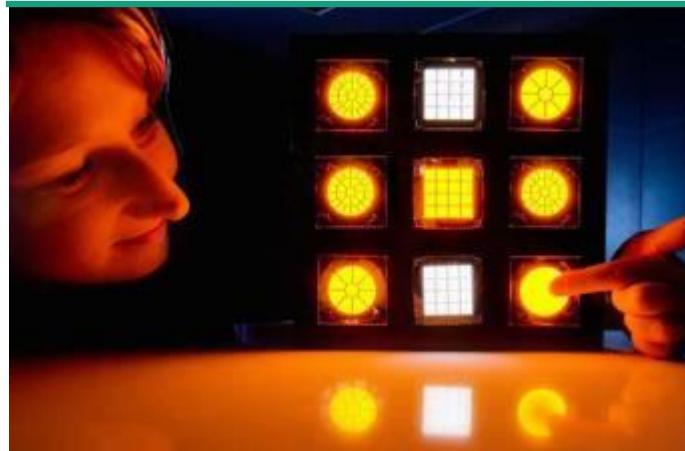
- Clean room 900 m², Labs 100 m²

Fabrication lines

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



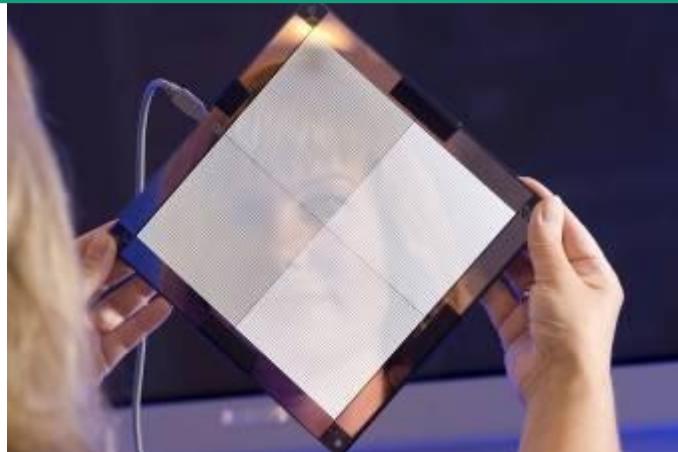
COMEDD APPLICATIONS



Signage



OLED on CMOS



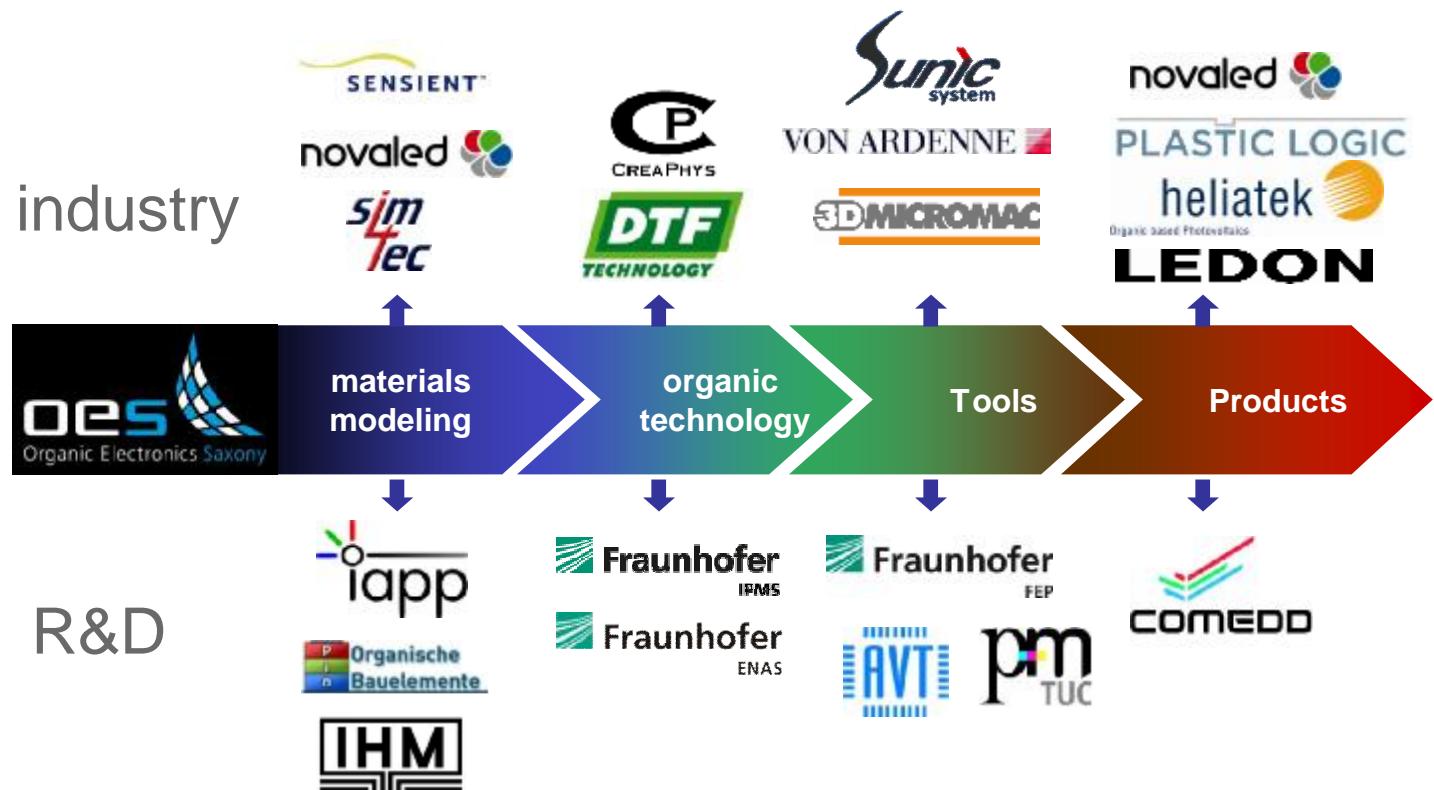
Lighting



Organic Photovoltaics

Organic Electronics
OLED displays
OLED lighting
Photovoltaics
Electronics: RFID
display-backplanes
Electronics
everywhere
Value chain
Members

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



VON ARDENNE

novaled

iapp

LAYTEC
optical sensors

alanod

3D MICROMAC

Fraunhofer
IPMS

Fraunhofer
FEP

CREAPHYS

LEDON

heliatek

Organic based Photovoltaics



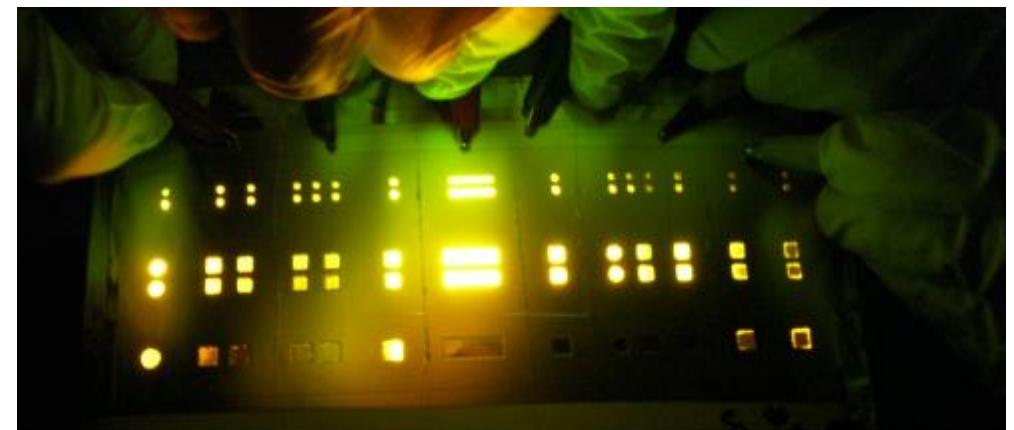
Bundesministerium
für Bildung
und Forschung

COMEDD

Fraunhofer
IPMS

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

- Visit Plastic Electronics Conference & Exhibition 2010 October 19-21, 2010, Dresden, Germany
<http://www.plastic-electronics2010.com/>

Thank you for your attention!



COMEDD

We shape the light.