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Highly Reliable OLED Devices for Automotive Applications

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About Optrex Europe GmbH (OEG)

(www.Optrex.de)

Joint Venture between Optrex Corp., Japan, and SiemensVDO (now Continental)

- development, volume production and sales of customer specific passive matrix LCD panels and modules in Germany and in Czech Rep. (backend, assembly); trading with LCD products from Far East production sites of Optrex Corp.
- market leader for advanced passive matrix automotive displays
- design, assembly and sales of high performance customer specific TFT devices
- development of advanced OLED devices in cooperation with german partners, funded by BMBF („CARO“)

ABN

STN

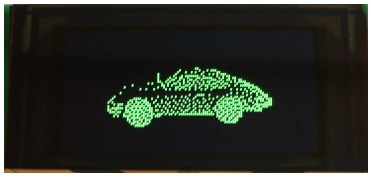
TFT

About German OLED Display Project CARO

Advanced - next generation- technology approach on
highly reliable and highly efficient OLED displays
for wide temperature range
customer specific car applications (incl. other appl.)
ranging from
signage (textured lighting) to medium resolution displays,
including new transparent solutions,
in a development collaboration by German industrial companies and research institutions:

- Advanced
- Materials
- Stacks
- Processing
- Driving
- System integration

CARO (CAR OLED)



(OLED device with 128x64 pixel)

Acknowledgement: The CARO project is kindly supported by German Ministry of Education and Research (BMBF) under 01 BD 680-688.

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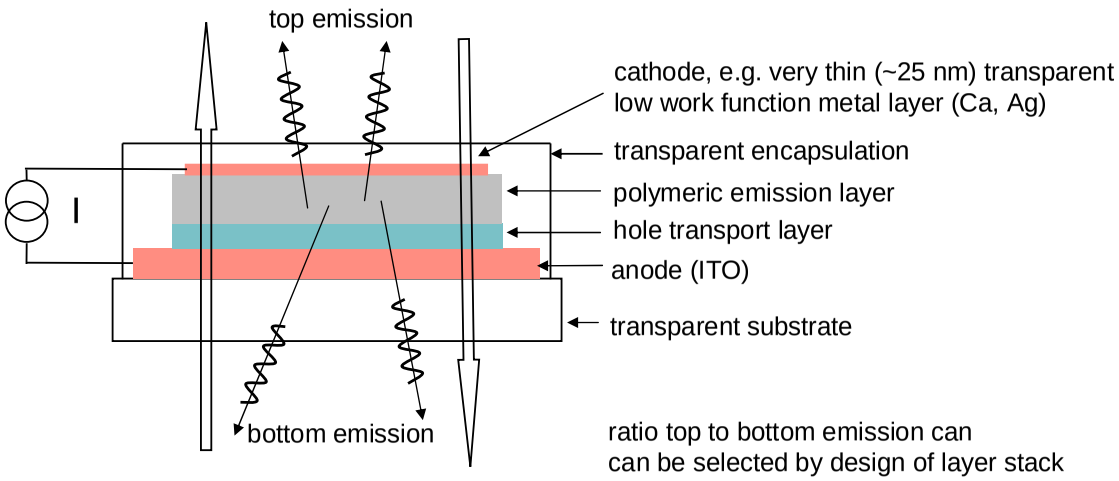
Transparent OLED Device (Example P-OLED)

Basic Cross Section



Some Potential Applications of Transparent OLED Devices*

Transparent OLEDs: New system design options – higher value

- „active lighting“ see-through displays in general
- windows / transparent walls with display function (e.g. for advertisement)
- information overlay in front of other displays or in front of complicated manual handling scenarios (like e.g. in surgery)
- 3D effects
- single layer both sides readable displays
- single layer light sources emitting in both hemispheres

* See also J. Wahl et. al., Proc. Organic Electronics Conference, Frankfurt 2006

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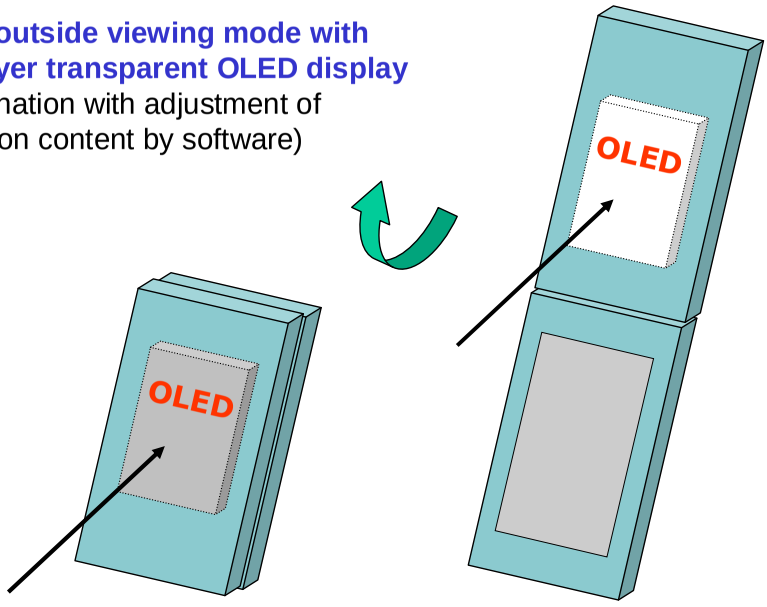
Example: Two Sides View

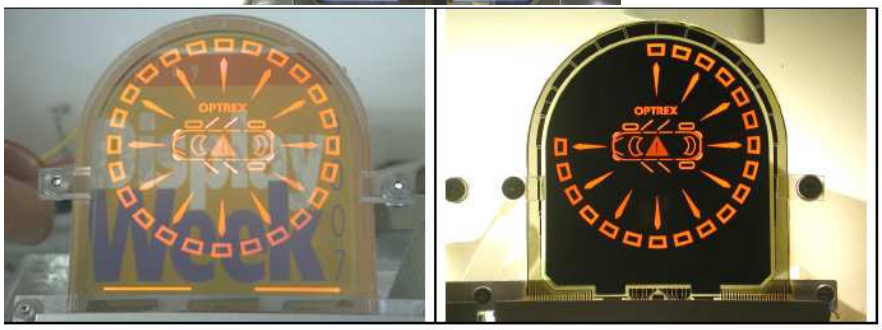
Inside – outside viewing mode with single layer transparent OLED display
(in combination with adjustment of information content by software)



Transparent Segmented P-OLED Demonstrator (Signage)

P-OLED: off *P-OLED: on*

Low Resolution Signage Demonstrator with Form Cut



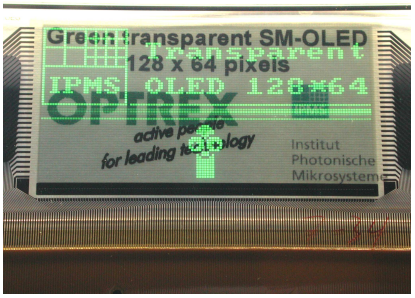
Transparent SM-OLED Non-transparent P-OLED

(Orange versions first shown during SID Display Week 2007 in Long Beach CA)

SM-OLED in cooperation with Fraunhofer IPMS Dresden, P-OLED in cooperation with Fraunhofer IAP Potsdam

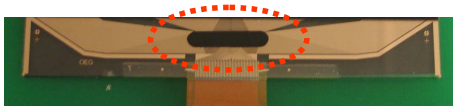
Transparent Passive Matrix SM-OLED with 128x64 Pixels

in front of a printed label



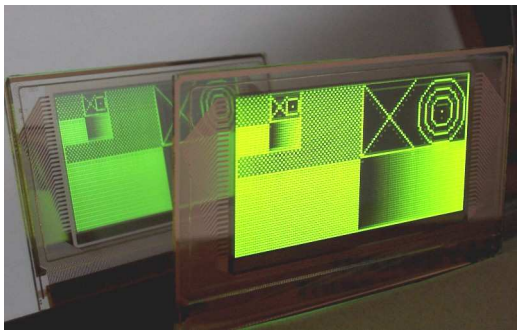
Interconnection with flat cable

or



Interconnection with Chip on Glass
(proprietary COG by OEG)

in front of a mirror (showing top emission)



Organic and cathode layers were coated on advanced in-line tools using linear evaporation sources (Fraunhofer IPMS, Dresden)

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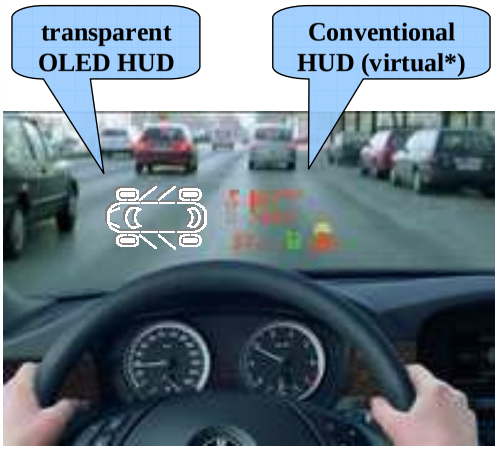
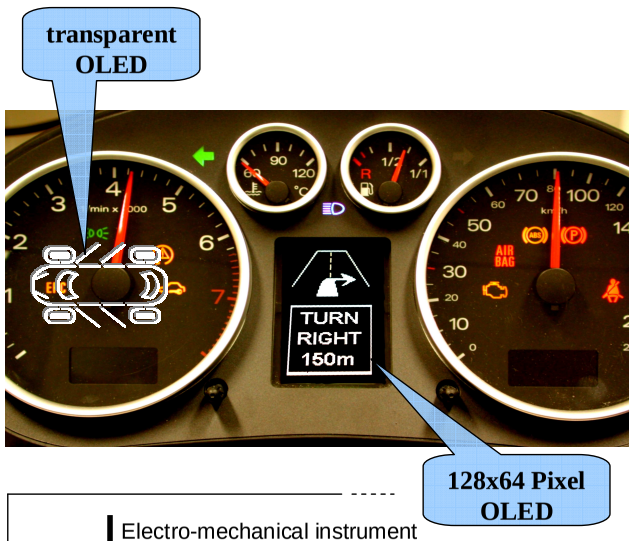
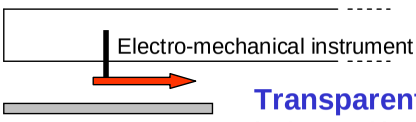
Examples of System Integration for Car Instrumentation



Transparent OLED as head-up display
(HUD) in windshield (simulated)

* virtual picture appears
a few meters in front of windshield



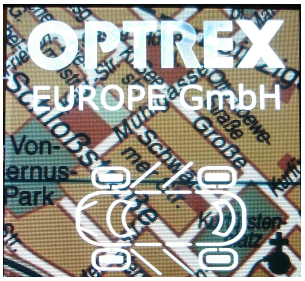


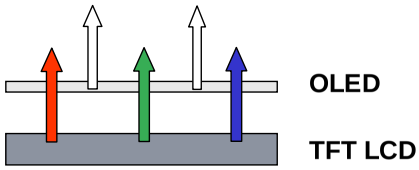
Transparent OLED as overlay
in front of instrument cluster (simulated)

- **additional information, no extra area**
- **3D appearance**

Dual Layer Information Display

Transparent OLED (P-OLED) in front of a TFT LCD
(TFT and experimental set-up by Optrex Europe GmbH)





3D effect by two OLED Layers

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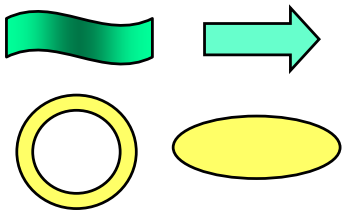
Other Examples of Potential Interior (Automotive) Applications

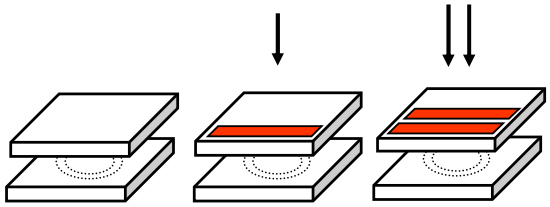
- **textured interior lighting, orientation signs, warning signals, ...**

ATTENTION



- **thin, homogeneous LCD backlight**

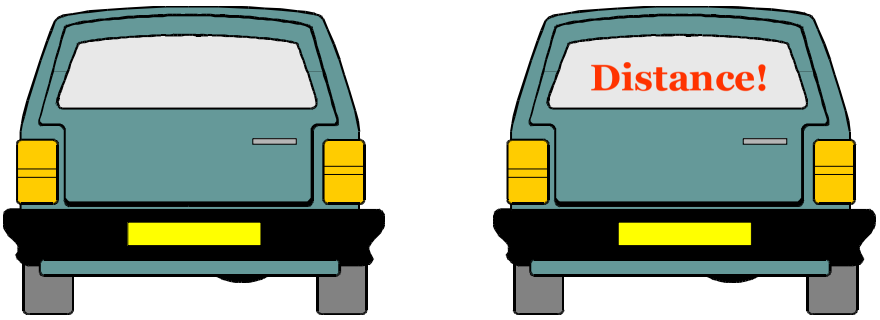
- **multi-state flat push buttons**



(transparent) OLED

switch

Example Car Window Application



Examples Exterior Car Applications

Intelligent Break and Flashing Light

Demonstrated by Optrex Europe GmbH during Electronica Fair, Munich 2004

Note:

Total operating time for such devices is relative low (less than hundred hours), but brightness must be very high

Summary and Outlook

- advanced, highly reliable OLED technologies and systems are developed within the German collaborative R&D project CARO
- transparent OLED technology offers new design and functional concepts for windows and displays and interesting perspectives for new applications of OLEDs which might generate significant additional business in future
- transmission, efficiency, lifetime as well as system design and potential manufacturing cost are major issues for further improvements
- printing technologies promissing esp. for low cost signage applications

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Thank you very much for your interest