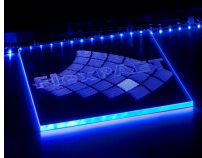


Production of next generation backlight units by adaptive step and repeat embossing



CAS Conference
October 13, 2010
Sinaia

Christoph Baum, Fraunhofer IPT

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Content



- Introduction
- Process Principles
- Machine Design
- Summary and Outlook

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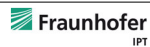
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Seite 2

Products and Target Markets



CONSUMER GOODS, HANDHELD LIGHTING

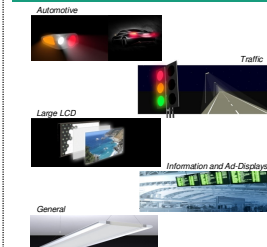
- LED lightguide technology
- LCD and keypad lighting solutions



Source: Oy Modines

GENERAL, SIGNAL, INFORMATION LIGHTING

- LED lens technology
- Information panel and traffic lighting solutions



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Seite 3

Backlight Units in LCD Screens - Specifications

- Display Luminance
 - 600 cd/m²
- Lifetime
 - 75 000 hours
- Power consumption
 - 70 W (40 inch)
- Luminance of Backlight unit
 - 14 000 cd / m² (BLU + diffuser sheet)
 - 7 000 cd / m² (BLU + diffuser sheet + Brightness Enhancements Film(s))

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Seite 4

Conventional CCFL-Back Light Unit

- Large displays mainly use cold cathode fluorescence lamps (CCFL) as light sources
- CCFL has good characteristics concerning light colour price and market share
- CCFL have drawbacks concerning
 - Mercury
 - Energy efficiency
 - Thickness of the setups
 - Electrical transformers

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Seite 5

LED Backlight Units

- Different approaches for using LED lights in LCD
 - Full Array Type
 - A matrix of LEDs is placed behind a diffuser sheet
 - Edge Lit Type
 - A light guide plate (LGP) is used for the emission of light
- Benefit
 - Low power consumption
 - Better colour reproducibility
 - Thinner setup (LGP type)

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Seite 6

LED Display

- Technology is very common for mobile devices and PC monitors / notebooks
 - Screen printed LGPs
 - SiO₂ dot pattern
 - TiO₂ dot pattern
- Next generation for use in large displays with better energy efficiency
 - Thinner LGPs
 - Higher uniformity to avoid diffuser plates
 - Directed light outcoupling to avoid BEF

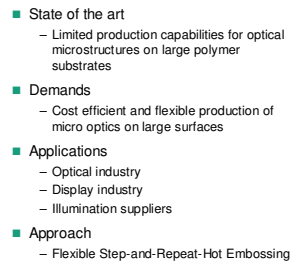
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FlexPAET

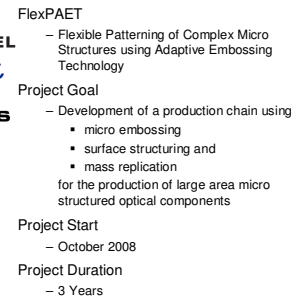


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FlexPAET



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FlexPAET

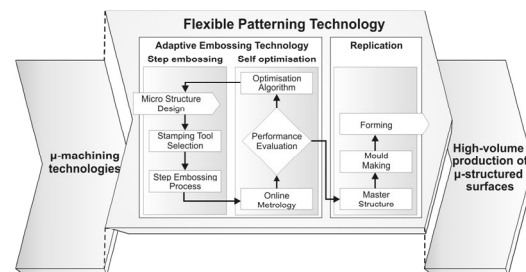
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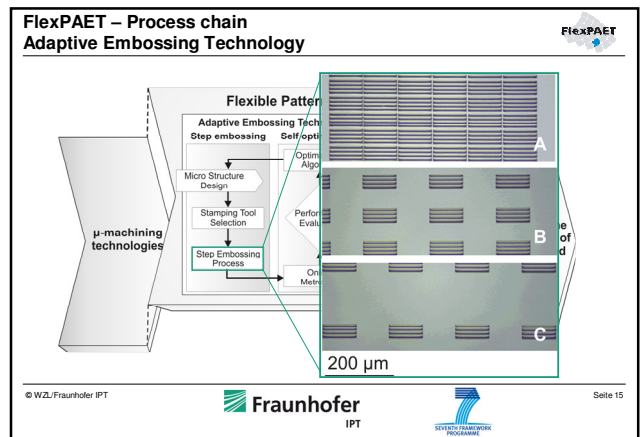
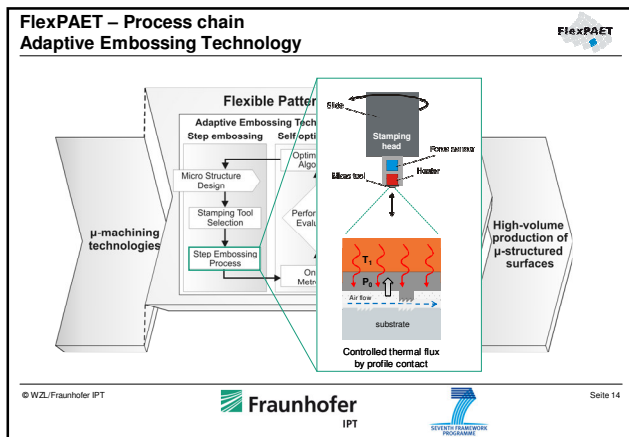
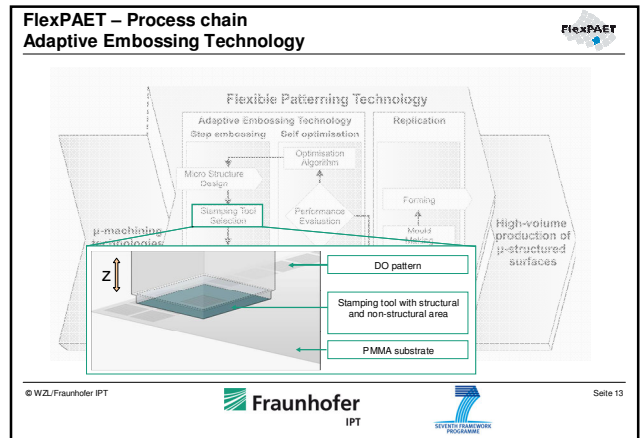
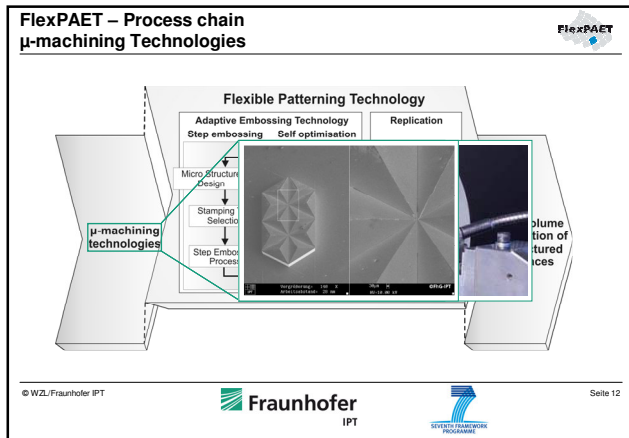
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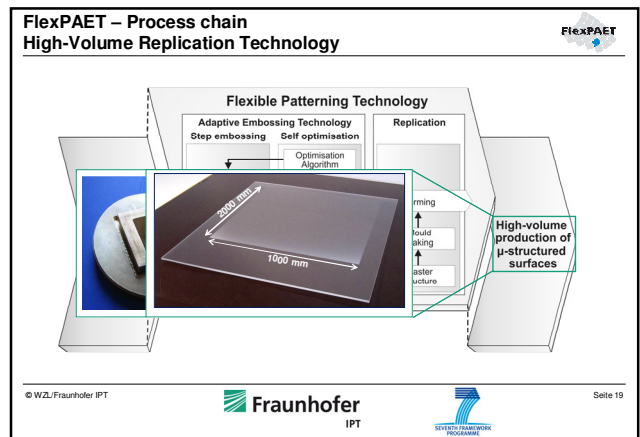
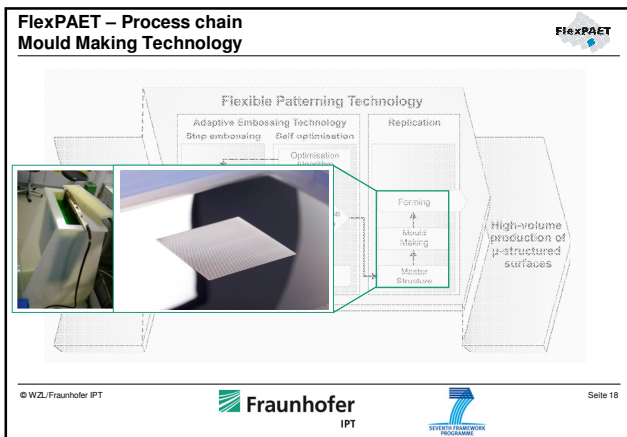
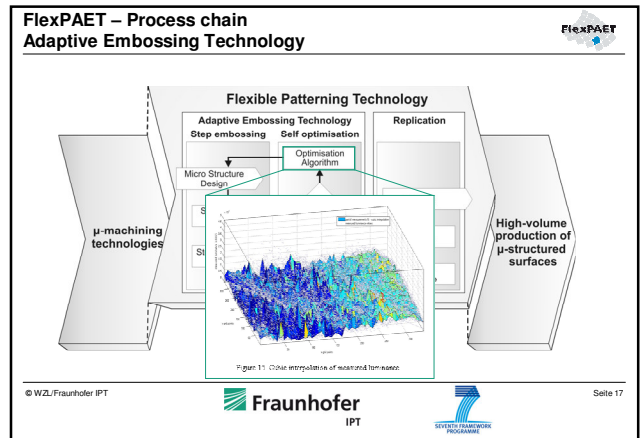
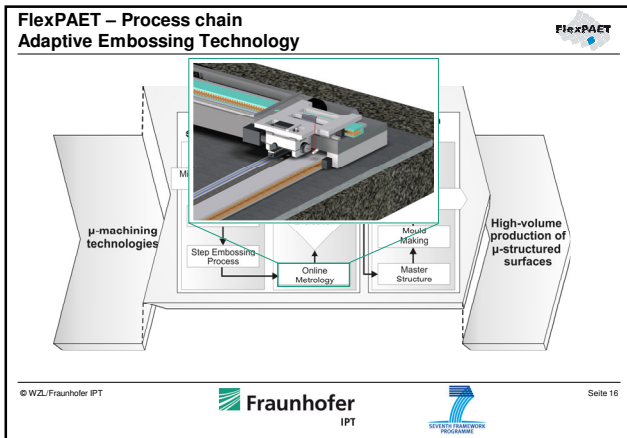


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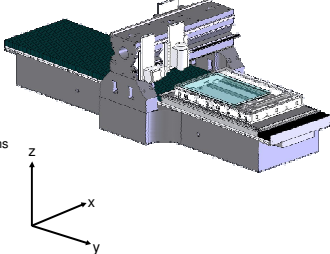
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SEITE FRAUNHOFER PROGRAMM

Seite 20

Machine Specifications		FlexPAET
■ Positioning accuracy	<ul style="list-style-type: none"> – 2 μm positioning accuracy in x-y-plane – 0.5 μm relative positioning accuracy in z-direction (embossing motion) – Automated compensation of substrate thickness variation 	
■ Metrology integration	<ul style="list-style-type: none"> – Integration of confocal microscopy – Integration of luminance sensors 	
■ Machining conditions	<ul style="list-style-type: none"> – Laminar-flow-box for clean room conditions – High accuracy air conditioning 	

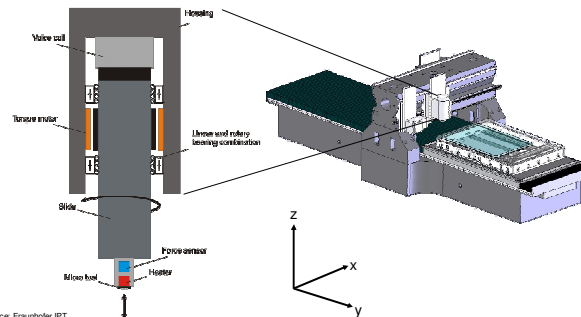
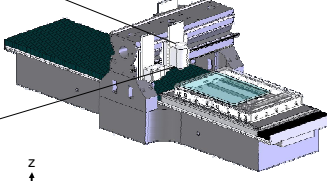
Source: Fraunhofer IPT

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Embossing Head Design		FlexPAET
		

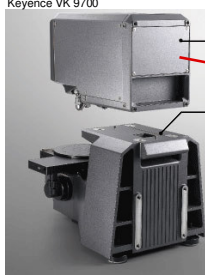
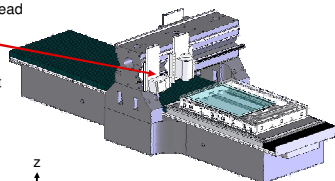
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Metrology Integration		FlexPAET
<p>Keyence VK 9700</p> 		

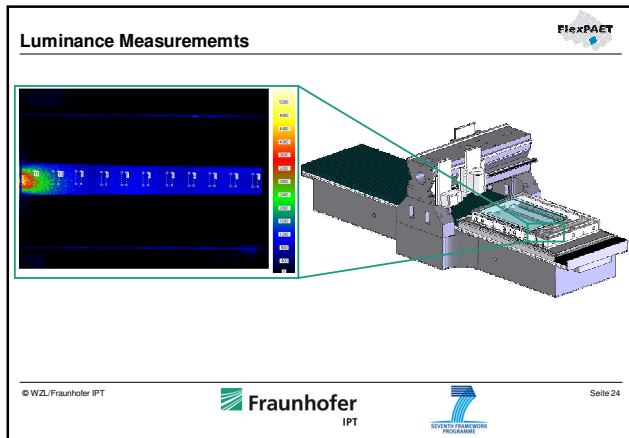
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SEVENTH FRAMEWORK PROGRAMME

Seite 25

Summary and Outlook

- Micro structuring by step and repeat hot embossing offers new opportunities for the production of large area structured surfaces.
- The combination with online inspection of optical functionalities enables iterative optimisation loops.
- A machine prototype for areas up to 300x300 mm² was built.
- Large area equipment, providing structuring capabilities up to 1000x2000 mm², will be available by the end of 2010.
- Subsequent to the mastering processes, electroforming processes allow for mould making for high volume production.

Source: Zumtobel Lighting

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SEVENTH FRAMEWORK PROGRAMME

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