JOANNEUM RESEARCH MATERIALS

Roll-to-Roll – R2R

Large area micro- and nanostructuring of foil-based materials for industrial production

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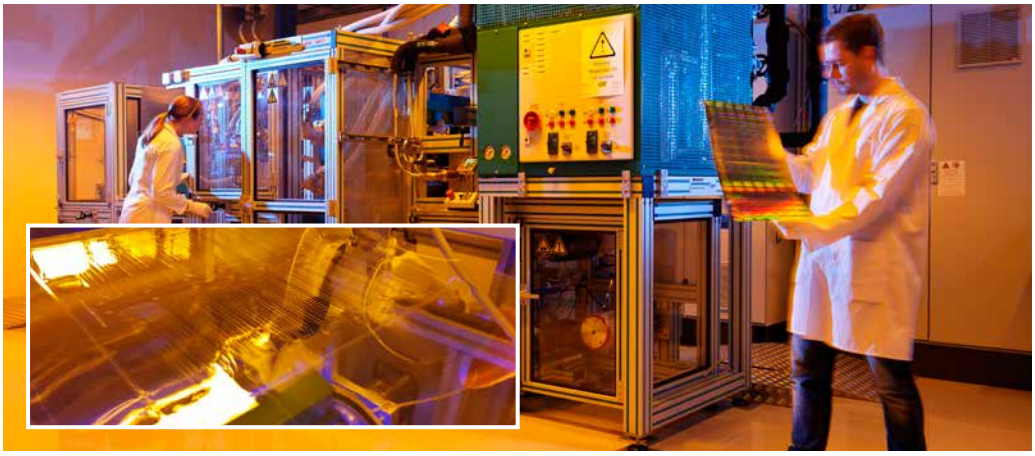
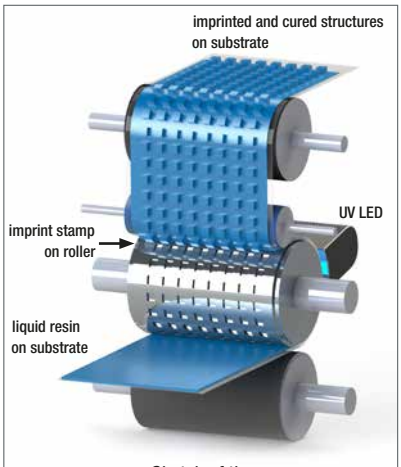
NILcure



The research group for Hybrid Electronics and Patterning has been involved in the development of manufacturing processes for optical, optoelectronic and electronic components for more than 10 years. The established knowledge in design, fabrication, characterization and optimization is now available to industry in combination with the roll-to-roll pilot line for the development of sustainable industry compatible manufacturing processes.

The utilization of roll-based imprinting processes enables the mass fabrication of micro- and nanostructures on large and flexible substrate materials. These can be used in optical, electronic, sensory or bionic applications. Roll-to-roll micro- and nanostructuring thus forms the basis for the development of novel and cost effective products in Key Enabling Technology fields such as biotechnology, nanotechnology, as well as advanced materials or advanced manufacturing and production technologies.

This continuous roll-to-roll process relies on a number of steps: (i) After unwinding, a flexible substrate plastic film is coated with the UV curable resin. Our NILcure® imprint resin portfolio offers a wide range of possibilities and the resin can be tailored in terms of mechanical, chemical and optical properties. (ii) The coated substrate is then guided to the imprinting station, where a stamp with the desired surface pattern is pressed into the liquid resin. The stamp is usually a nickel or polymer sheet with excellent anti-sticking properties wrapped around the imprinting roller. (iii) While in contact with the stamp, the resin is cured by UV light. Afterwards the imprint is demolded and wound up.



Sketch of the Roll-to-Roll Imprinting Unit

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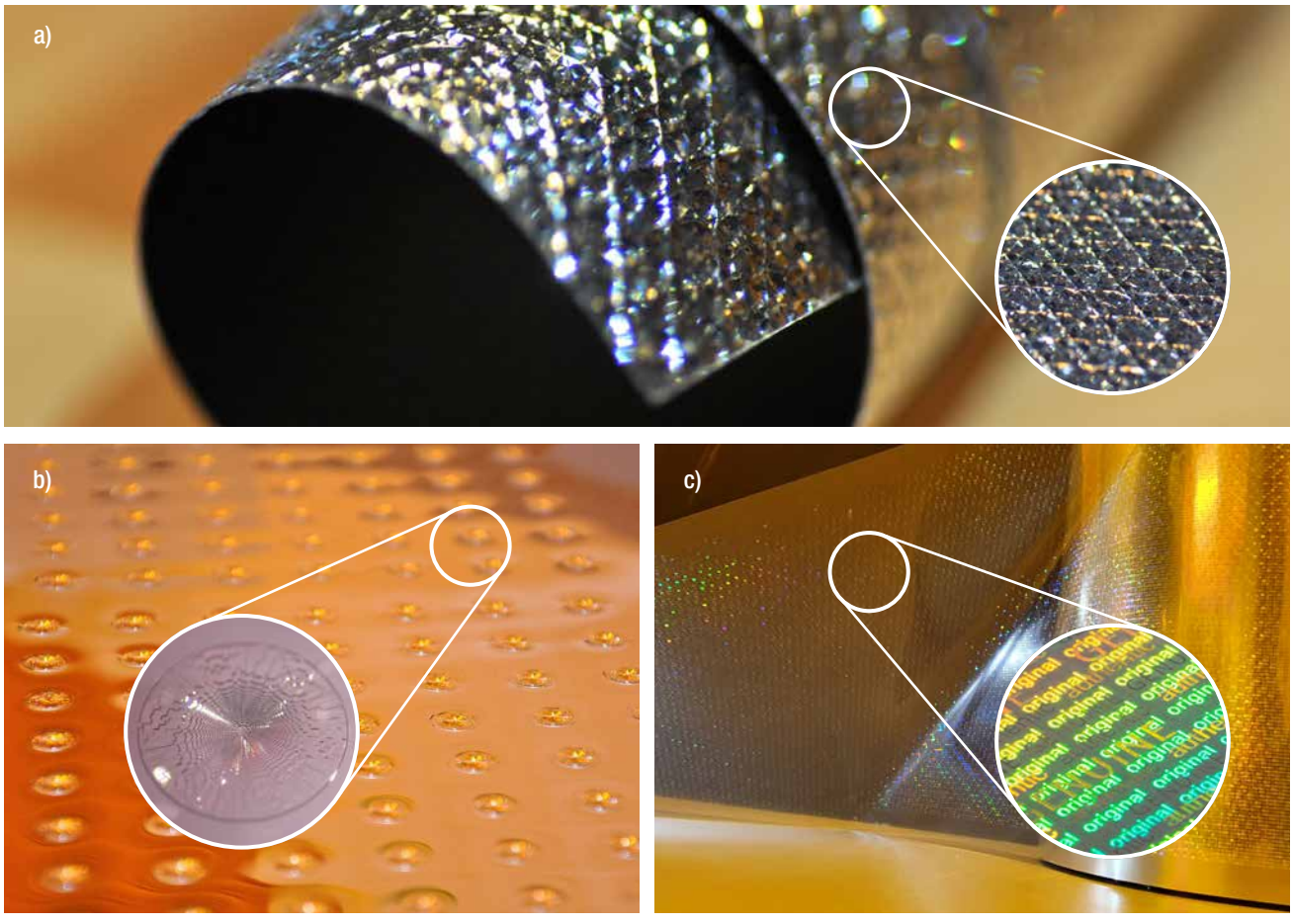
Specification:

Resist coating by means of gravure printing or slot die coating	Coating thickness range	200 nm – 200 µm
UV imprinting and hot embossing	UV LED irradiance Mercury vapour lamp	max. 14 W/cm², 365 or 395 nm max. 18 W/cm², broadband
	Line pressure UV imprinting	max. 60 kN/m
	Line pressure hot embossing	max. 330 kN/m
	Temperature hot embossing	max. 200°C
Lamination	UV lamination	
Substrate	Transparent films	width 250 mm
Throughput	Web speed	0.5 – 30 m/min
Pre-treatment	Corona	max. 1000 W
In-line characterisation	Line scan camera	Resolution 5 µm
	White light interferometry	200 nm – 200 µm



Roll-to-roll imprinted film with a) decorative structures, b) free form micro optics and c) security features.