

EVG[®]750 R2R

Automated Roll-to-roll Hot Embossing System

Introduction

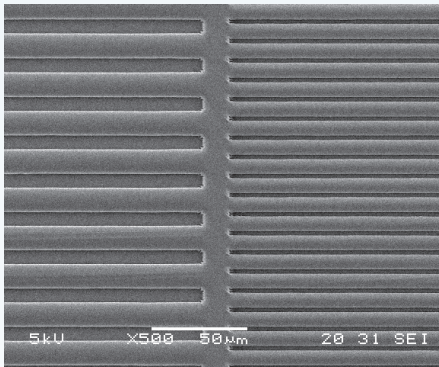
Roll-to-roll hot embossing allows micro patterning of flexible foil-based polymer substrates. Using rolls instead of plates enables continuous molding with significant advantages in operational speed and device throughput. In roll-to-roll hot embossing a thermoplastic sheet passes between two rotating rollers. The deformation of the thermoplastic material under the pressure and elevated temperature of the mold imprints the structures into the polymer. Imprinting also allows the creation of 3-dimensional and aspherical structures in one step which additionally lowers the number of required process steps.



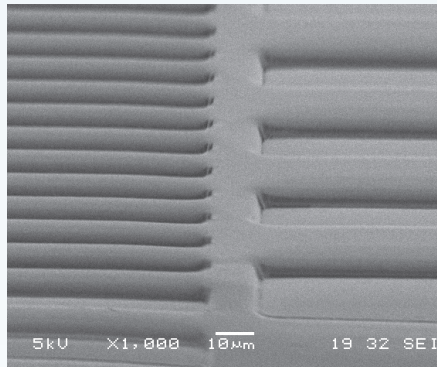
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Roll-to-roll processing

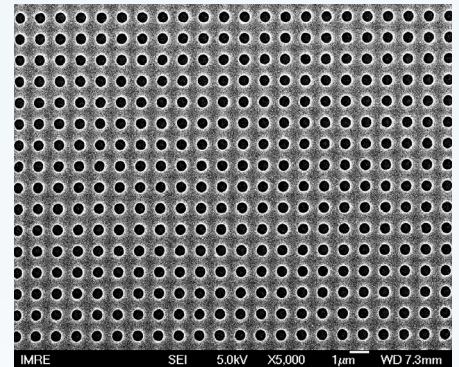
In roll-to-roll hot embossing thermoplastic polymer films are heated well above the glass transition temperature of the thermoplastic materials. Once the target temperature is reached, the foil is moved through the two embossing rollers. The impression roller applies a uniform force across the entire width for accurate structure transfer. Additionally, a cooling unit supports the temperature drop below the glass transition temperature of the thermoplastic polymer for immediate solidification and reduced thermal reflow.



SEM image of 10 μm and 30 μm microfluidic structures replicated into PMMA



Tilted SEM image of 10 μm and 30 μm microfluidic structures replicated into PMMA



SEM image of 500 nm holes replicated into PMMA

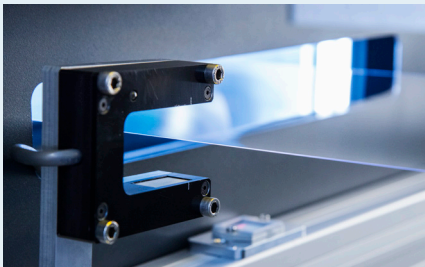
Benefit

- Ability to use various materials in small volumes which aren't available on rolls
- Automated substrate and roller position matching for easy operation
- Green technology - Unique roller heating for reduced energy consumption and less idle time
- Automated wedge compensation for superior pattern transfer

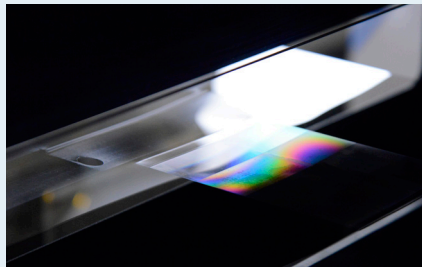


Features and Technical Data

Foil Handling Units	
Speed	0.5 m/min up to 20 m/min
Foil width	300 mm
Foil thickness	50 µm up to 1000 µm
Winding weight	< 100 kg
Materials	PC, PMMA, PET, PS
Unwind - Rewind Unit	
Winding accuracy	< 100 µm
De-ionizer	2 de-ionizers after protective film removal and embossing
Splicing Table	For integration of polymer films in sheet format on unwind and rewind unit
Protective film removal	Integrated on unwind unit
Tension control	Active tension control
Speed control	Active speed control and feedback to rewind unit
Embossing Unit	
Imprint Force	up to 10 kN
Heating	Up to 200 °C
Cooling	Immediate cooling after embossing
Structure size	From < 50 nm up to several 100 µm
Optical sensor for splice detection	Integrated on embossing unit
Rotary encoder	Rotational adjustment of stamp and substrate position



Ultrasonic Edge Guide Sensor



Imprint result



Rewinding of imprinted foil



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