



Morphotonix

Nanopatterning steel tooling for industrial applications

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SURFACE NANO-PATTERNING

Application Area	Examples of Applications
Optics and Photonics	<ul style="list-style-type: none">-Photonic Crystal fabrication-Anti-reflective coatings-Diffractive elements / security markings
Biosensing and Diagnostics	<ul style="list-style-type: none">-Bio-functionalized surfaces for biomolecule detection-Surface-enhanced Raman spectroscopy-Micro-arrays and lab-on-chip devices
Nanoelectronics and NEMS	<ul style="list-style-type: none">-Field-effect transistors-Nano-wire based sensors and photodetectors-NEMS
Surface Engineering and Functionalization	<ul style="list-style-type: none">-Surface wetting property modification-Superhydrophilic/superhydrophobic surfaces-Tribological systems, micro/nanomachines
Energy and Environmental Applications	<ul style="list-style-type: none">-Solar energy harvesting-Energy storage devices (batteries, supercapacitors)
Biomedical Engineering and Tissue Eng.	<ul style="list-style-type: none">-Nanostructured scaffolds for tissue engineering-Surface modification for medical implants-Drug-delivery systems with nano-structured surfaces



NANO-PATTERNING FOR MOLDING

Application Area	Examples of Applications
Optics and Photonics	<ul style="list-style-type: none">-Anti-reflective coatings-Diffractive elements / security markings
Biosensing and Diagnostics	<ul style="list-style-type: none">-Micro-arrays and lab-on-chip devices
Nanoelectronics and NEMS	
Surface Engineering and Functionalization	<ul style="list-style-type: none">-Surface wetting property modification-Superhydrophilic/superhydrophobic surfaces-Tribological systems
Energy and Environmental Applications	<ul style="list-style-type: none">-Solar energy harvesting
Biomedical Engineering	<ul style="list-style-type: none">-Surface modification for medical implants



MORPHOTONIX GOALS

Initial requirements	Development
Differentiation from Ni shims and laser	<ul style="list-style-type: none">-on free-form shapes-on customer steel tooling-long lifetime in production-control of nanostructure lateral size/depth
Wafer size (4inch, potentially scalable)	<ul style="list-style-type: none">-start with smaller areas, in time develop for larger ones
Plug & play for the industry	<ul style="list-style-type: none">-no change in production: tool temperature/cycle time/special materials-standard tool maintenance
Efficient metrology available	<ul style="list-style-type: none">-SEM inspection not an option- binocular/optical/confocal microscopes
Modular and scalable processing	<ul style="list-style-type: none">-No single machine dependency-De-risking via modular sub-processes-Easier to transpose in other working environments



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MORPHOTONIX GOALS



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PROBLEM - COUNTERFEITING



China 2021:
\$2.8M Counterfeit Vaccines

 liabilities



Latin America 2019
400 tones of counterfeit shampoo

 reputation

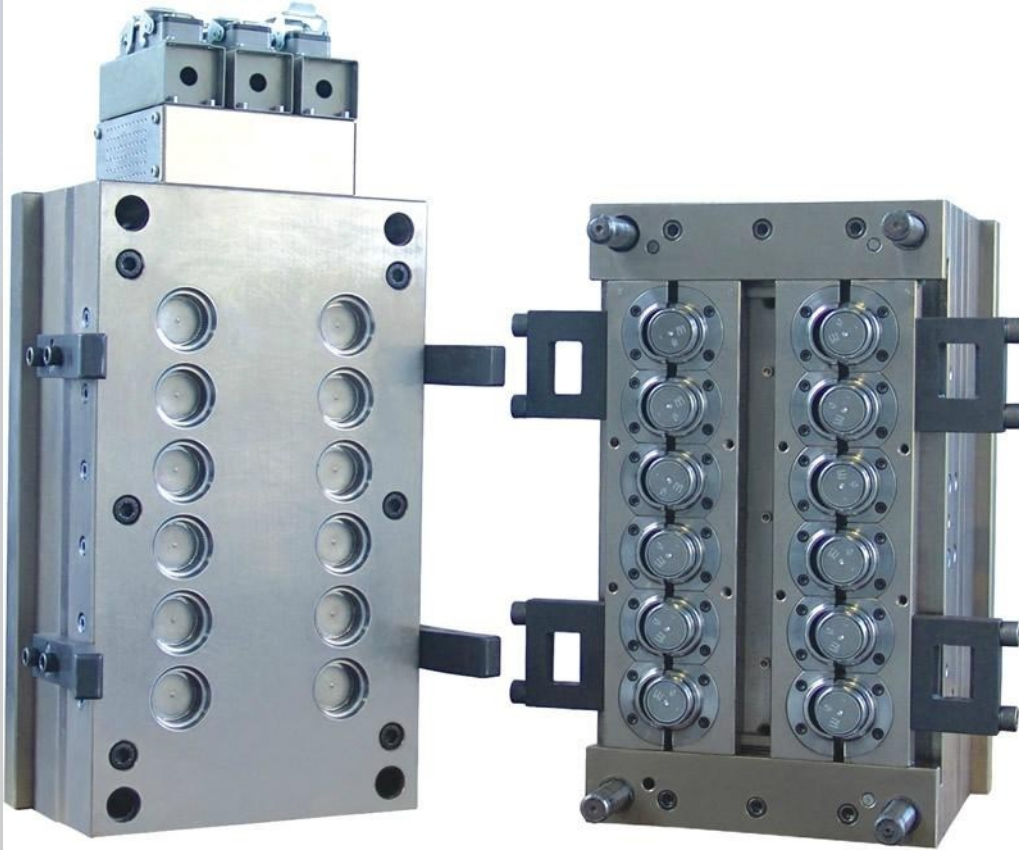


US 2015
Military-grade Semiconductors

 sales



MOLDING LINE



Mold

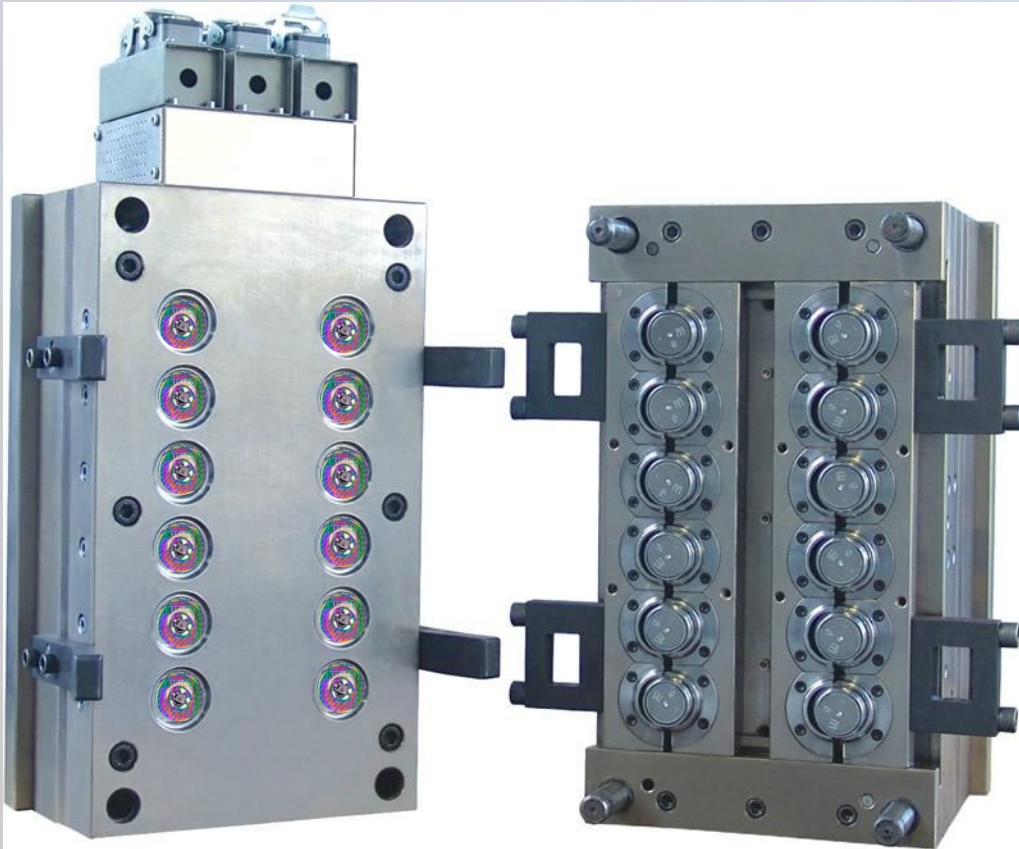


Molding line

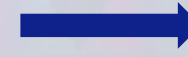
Original our counterfeit?



NANO-MARKED MOLDING LINE



Nano-marked mold



Nano-marked original

NANO-MOLDING EXPERTISE



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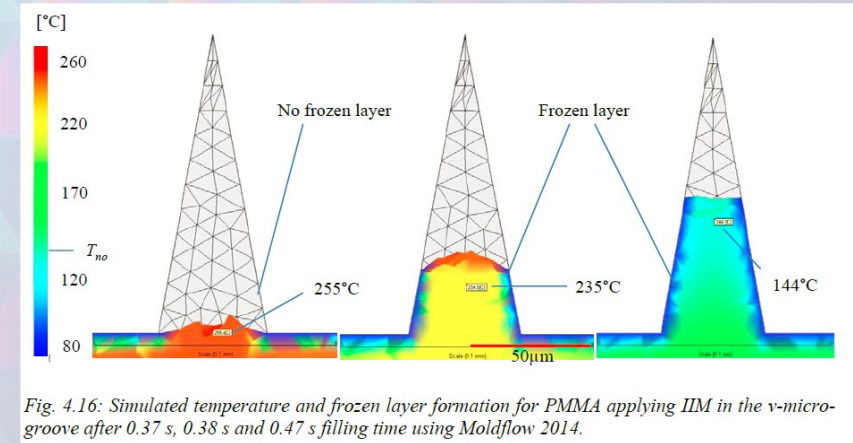
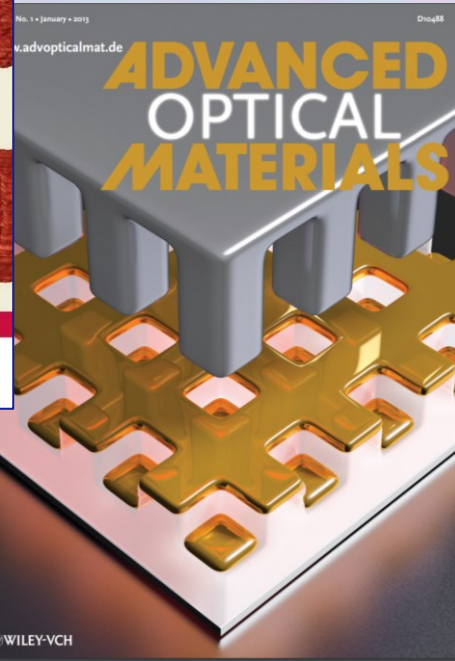


Fig. 4.16: Simulated temperature and frozen layer formation for PMMA applying IIM in the v-micro-groove after 0.37 s, 0.38 s and 0.47 s filling time using Moldflow 2014.

<http://dx.doi.org/10.17877/DE290R-17239>

n|w Fachhochschule Nordwestschweiz
Hochschule für Technik

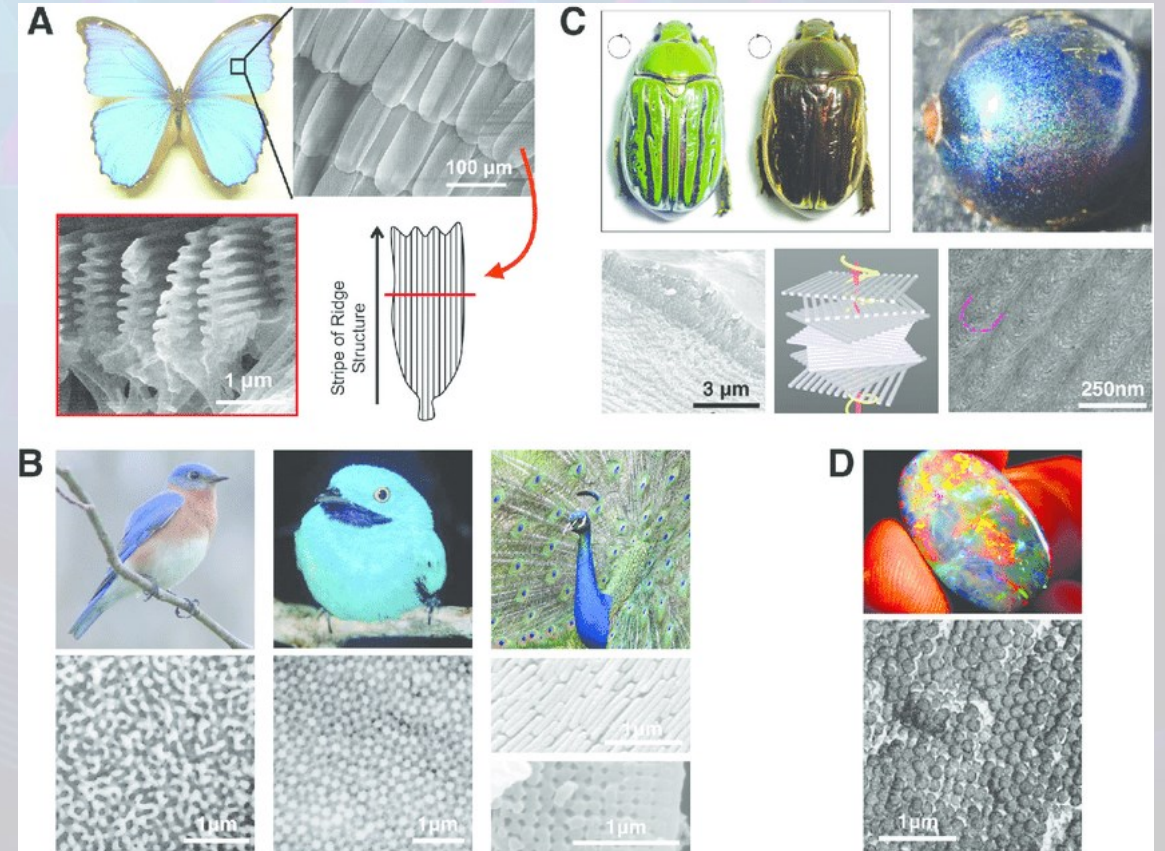
Horizon 2020
European Union Funding
for Research & Innovation

EPFL

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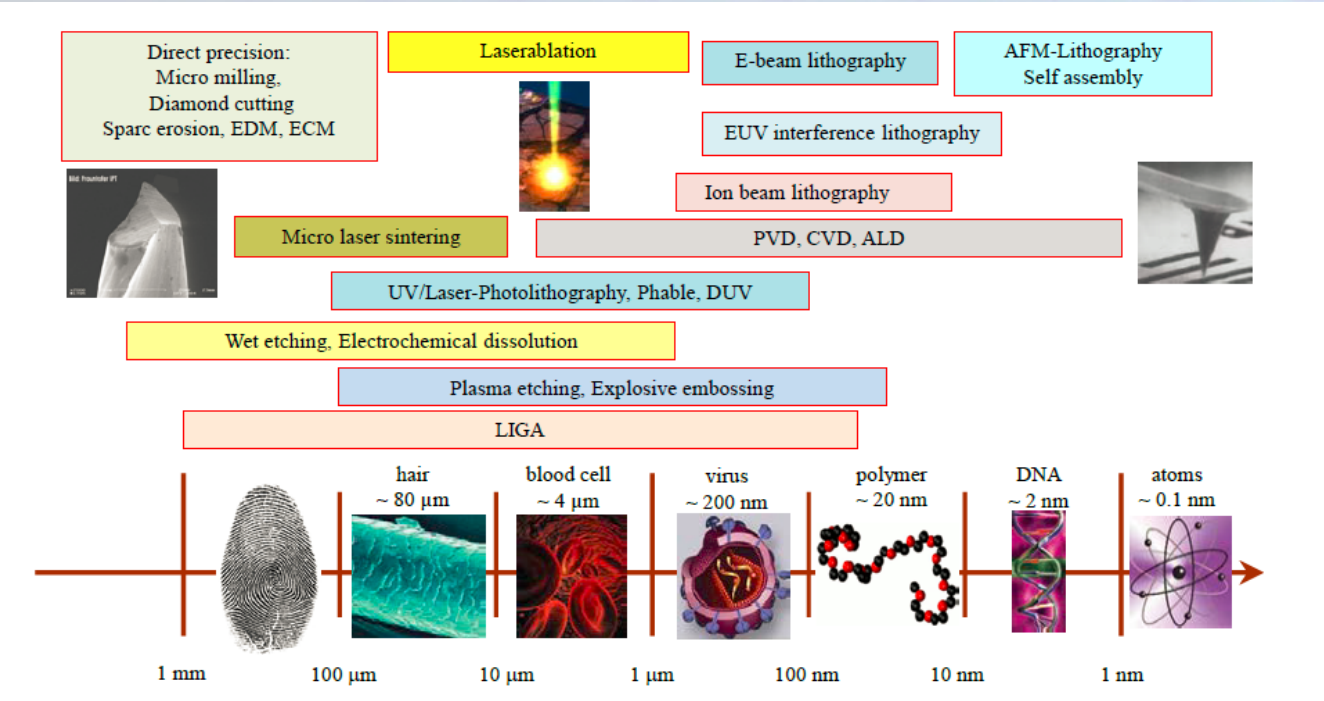
STRUCTURAL COLOR



https://www.researchgate.net/figure/Structural-colours-in-nature-that-have-attracted-significant-biomimicry-efforts-A_fig2_306074997



HIGH-SECURITY

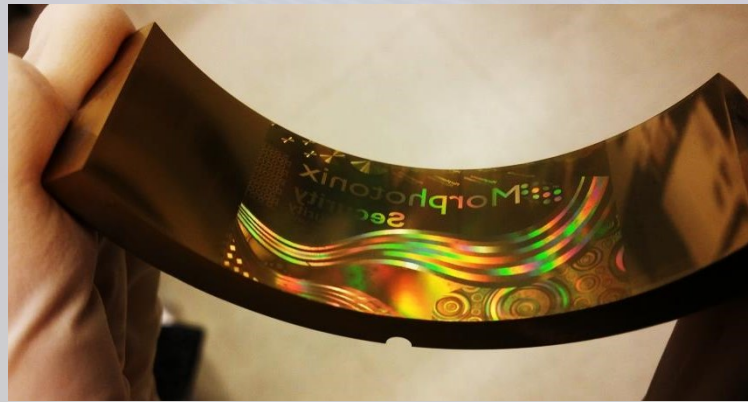


<http://dx.doi.org/10.17877/DE290R-17239>

Patented and proprietary technology WO2016181253A1

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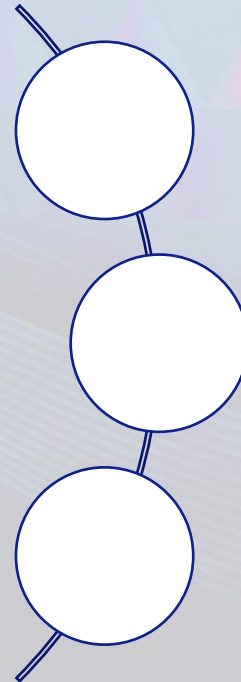
COMPLEX DESIGNS





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APPLICATIONS



Medical/pharma

High-tech parts, IT

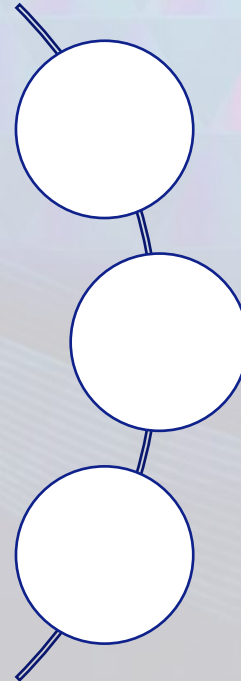
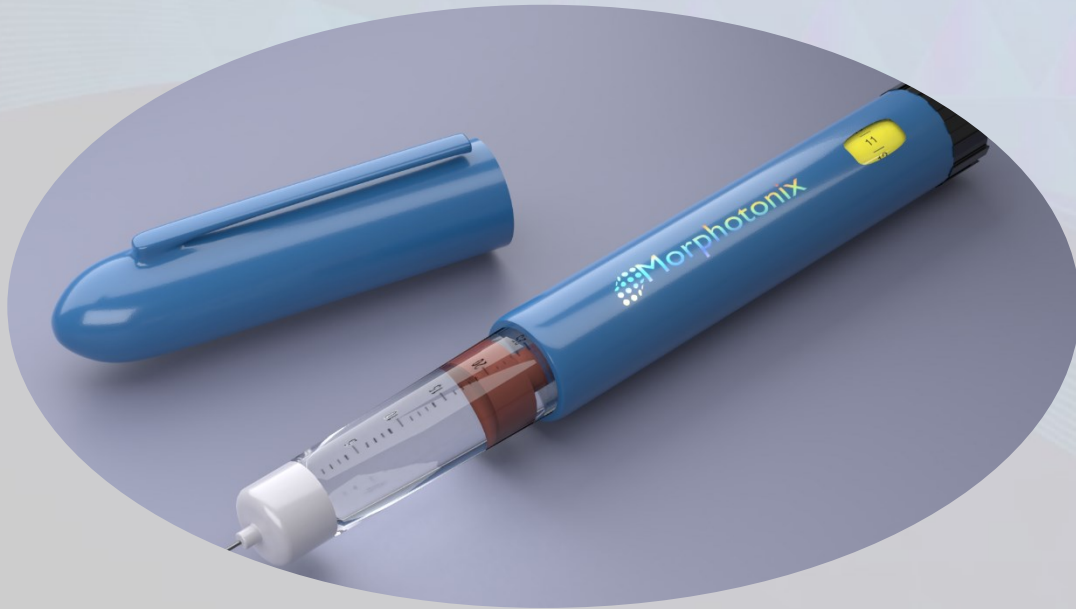
Packaging food/chemicals

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ADVANTAGES



Product-embedded

ZERO additives

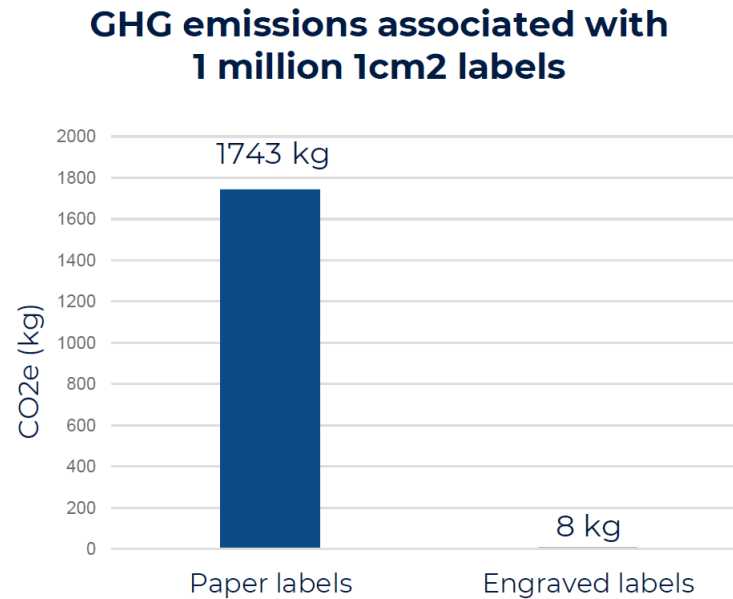
Lowest C-footprint

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LOW C-FOOTPRINT PHYSICAL SOLUTION

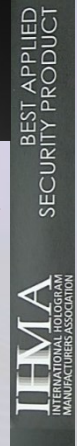
For 1 million products labelled with a 1cm² label, engraving an existing mold will be associated with 8kg CO₂e compared to 1743 kg CO₂e for ordering paper labels and glue.





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INTERNATIONAL RECOGNITION



					
SELECTED PARTICIPANT USA CHINA	BEST APPLIED DECORATIVE PACKAGING	SELECTED PARTICIPANT STARTUP COMPETITION	SME 1 EUROPEAN PROJECT	BEST APPLIED SECURITY PRODUCT	BEST TECHNICAL ACHIEVEMENT
VENTURE LEADERS 2015 2016	EXCELLENCE IN HOLOGRAPHY (IHMA) 2016	IMD LAUSANNE 2015	EUROPEAN COMMISSION 2019	INT. HOLOGRAM MANUFACTURERS ASSOC. 2017	IN-MOLD DECORATING ASSOC. 2019

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NEW: CERAMICS



Ceramic Injection Moulding: The impact of variotherm and conformal cooling technology on part quality and process capability

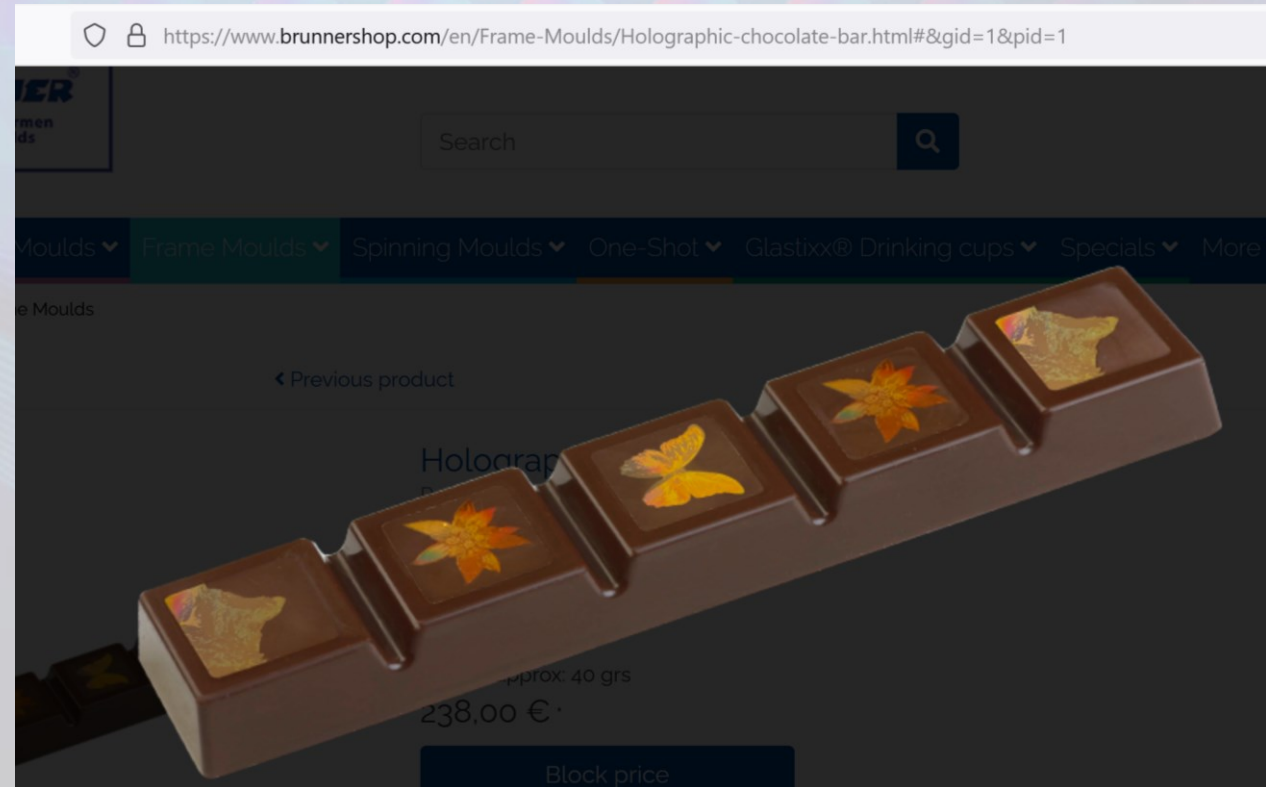
Despite the success of Ceramic Injection Moulding (CIM) in multiple end-user sectors, from luxury watches to automotive interiors and industrial engineering, there remains considerable scope for process optimisation to advance part quality, productivity and overall process capability. As part of the 'CIM++' research project, Ceramaret, Primaform and the iRAP institute investigated the potential of a variotherm control system for the CIM process and, as the results presented here demonstrate, significant improvements were achieved.



Fig. 1 Optimising the Ceramic Injection Moulding process with variotherm technology delivers improvements in process stability and quality. In relation to the manufacture of holographic structures such as this, significant advances in quality and process capability are achieved (Courtesy iRAP Institute, HEIA-FR/HES-SO, Morphotonix)



HOLOGRAPHIC CHOCOLATE



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