Status of the Patent
Priority Application in Austria and PCT filed.

Terms of use of ICE-process
Cooperation may range from joint commercialization of the technology, to technology licensing up to complete transfer of know-how and rights.

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Technology offer

3D Patterning of Micro and Nanostructures by Ion Controlled Etching (ICE) process

Ion implantation controlled reactive ion etching (RIE) process for high resolution patterning of 3D structures
Features of ICE process:
- High resolution structures by localized ion implantation (<50 nm half pitch)
- Superior height-control by automated adaption of etch gas composition
- Unlimited 3D design possibilities as process features fully adaptable slopes
- Applications: lenses, micro-fluidics, biomimetic surfaces and 3D nanosystems

Easy implementation:
- Inline control-loop for automated fine-tuning of complex 3D-structures
- Implementation of Process with commercial standard equipment
- Process designed for deployment in large volume production
- 3D-structures tested for nanoimprint lithography (NIL)-replication

Background:
3D micro- and nanopattern are desirable in many applications such as biomimetics, microoptics and microfluidics. Since the introduction of nanoimprint lithography (NIL) also the mass-fabrication has become feasible. The deficit of this fabrication technique is the manufacturing of NIL stamps with 3D patterns. Multilevel patterning using electron beam lithography is currently the most prominent workaround for high resolution patterns. However, this technique is costly and permits only patterning of discrete height levels. The ICE-process provides an innovative solution to this deficit.

Technology:
TU Wien offers a novel direct-write fast patterning process for real 3D-structures. It uses localized ion implantation into Si using a focused ion beam (FIB) together with an implantation-adapted reactive ion etching (RIE) step to fabricate 3D patterns. This process permits deliberate adjustment of the local height level of the pattern and achieves a high lateral resolution down to 50 nm half pitch. The implantation controlled etch process (ICE) allows inline height control and process adaption for accurate height control and minimal height tolerances.

Process-flow:
Design → 3D CAD data
ICE process
Choose optimized etch process
Calculate ion dose profile
Implant
Etch
Product

Potential applications:
Potential applications cover all processes taking advantage of 3D patterns. The ICE-process is especially suitable for microfluidics, microoptics, biomimetic surfaces and 3D-nanosystems.

Application example: NIL stamp for micro lenses

Left: Design; Center: Atomic force microscopy (AFM) image of fabricated master stamp; Right: AFM image of working stamp fabricated imprint by NIL (Please note: The discrete height levels visible are due to the limitation of the used equipment, not the process).

Potential users:
This offer adresses potential users in the field of:
- Tool manufacturers offering this proprietary process as an added value
- NIL template shops with demand of real 3D templates
- Manufacturers of nanopatterned surfaces (e.g. biomimetic surfaces)