

Mastering; more than just litho and etch....

T. Nielsen, B. Bilenberg, and N. Hansson

NIL Technology, 2800 Kongens Lyngby, Denmark

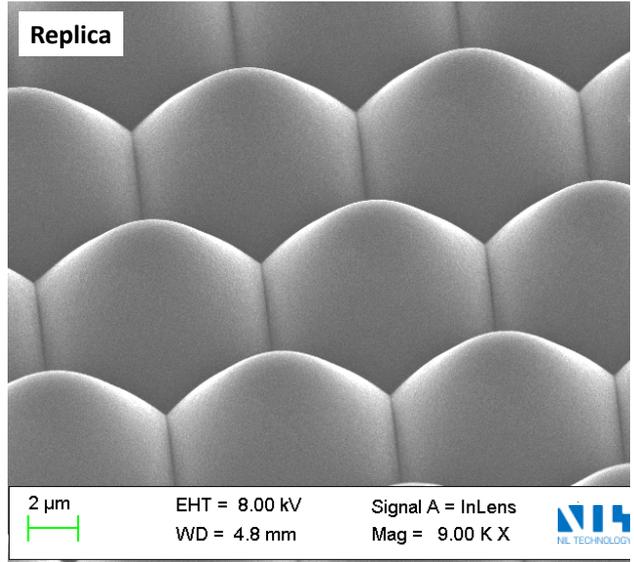
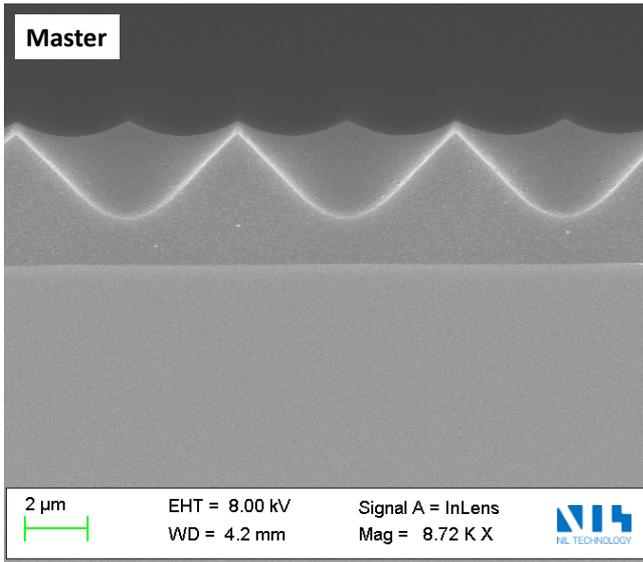
theo@nilt.com

Mastering: Litho and etch. Simple. Easy. All you need is.... Well, the more complex the final product gets, things become less trivial. Here we present NILTs latest development within mastering to support novel optics products. Focus is on high precision masters for high volume manufacturing for diffractive optical elements, micro lens arrays (spherical and aspherical) and advanced planar waveguides including in- and out coupling features. Examples of applications for this type of mastering structures are infrared optics, and AR/MR.

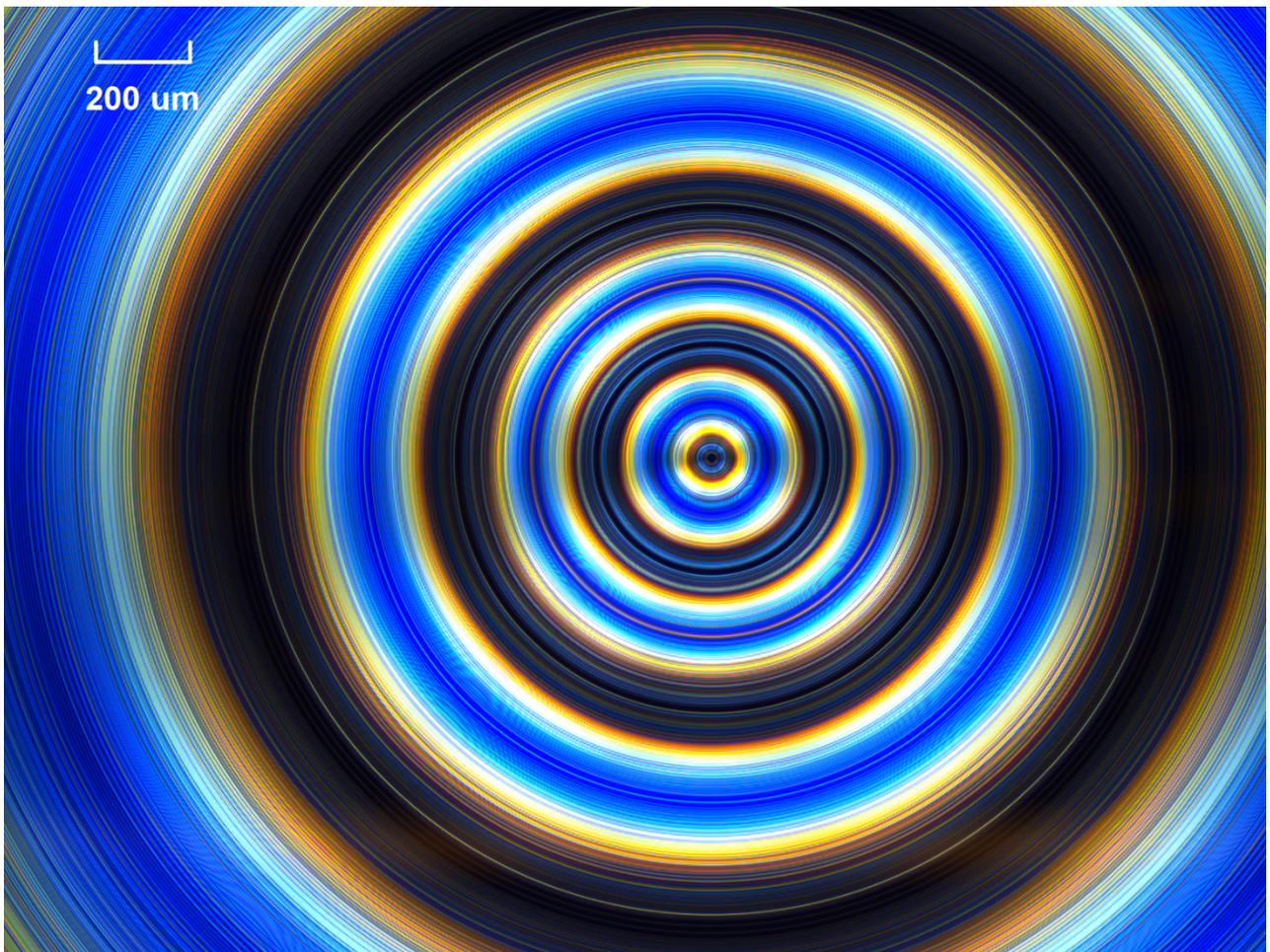
Diffractive optics offer a wide range of opportunities over refractive optics, but the mastering is not trivial! We present here the latest developments and our route towards product integration!

Micro lenses: Regular greyscale manufacturing no matter if it is by greyscale EBL or greyscale based on laser, there is a dead space between the lenses or to be more exact, there is a radius of curvature. NILT has developed a process based on e-beam that counteracts this issue which makes it possible to achieve very high fill factor. This has an impact in particular on aspherical lenses that are relatively small. Latest results will be presented.

NIL Technology (NILT) has more than a decade's experience in supplying masters for nanostructure replication. NILT is a dedicated supplier of masters for nanoimprint and nano-replication. NILT is supplying masters in silicon, fused silica and nickel. The masters are manufactured by the use of electron beam lithography, DUV lithography and direct laser writing in combination with advanced etching processes. In particular for masters for complex optical structures NILT has developed a wide range of advanced processes to manufacture masters for replication of spherical and aspherical micro lens arrays and multilevel DOEs and diffusers as well as blazed and slanted gratings and binary gratings. All our processes are unique and offer superior properties on key parameters like surface smoothness, CD, density, sidewall angles etc.



Aspherical MLA, master and replica



500 nm linewidth, 4-level, DOE, concentric circles master