



200 mm long laser drilled  
PCF geometry in BK7.

## Inverse laser drilling for the production of fiber preforms

The state of the art for manufacturing preforms for low-loss hollow structural fibers is the stack-and-draw process. However, stacking the preforms is not only very costly, but also limits the geometry of the mold and arrangement of the hollow structures, since asymmetric structures or changing the hole spacing cannot be stacked at will. In principle, it is simpler and more advantageous to drill out the corresponding openings from a high-purity fused silica rod.

### Further development of inverse laser beam drilling

In collaboration with the Max Planck Institute for the Physics of Light MPL and the Fraunhofer Institute for Silicate Research ISC, Fraunhofer ILT is continuing to develop inverse laser beam drilling (ILB) to produce preforms for hollow structural fibers with new geometries. In ILB, pulsed laser radiation is focused from above through the workpiece onto its underside. For the hole, the desired geometry is now ablated layer by layer from bottom to top. The MPL identifies advantageous geometries, draws the fibers and tests them. The ISC supports the process development on the material side. First, ILB produces preforms, which can also be stacked to compare the two methods. Subsequently, new, non-stackable geometries are tested.

### Results and applications

To date, Fraunhofer ILT has successfully drilled several different geometries, both stackable and non-stackable, over 50 mm in length in BK7 and have developed better process understanding. In addition, the institute has fabricated a single ring hollow core fiber preform using ILB. In the next steps, further geometries will be drilled in fused silica (e.g. Heraeus F-300) and the corresponding preforms will be drawn to the fiber. In principle, ILB is suitable for drilling hollow structures with large aspect ratios or for stress-free insertion of filigree hollow structures into dielectric materials. The project is being funded as part of an internal cooperation between the Fraunhofer-Gesellschaft and the Max Planck Society.

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