



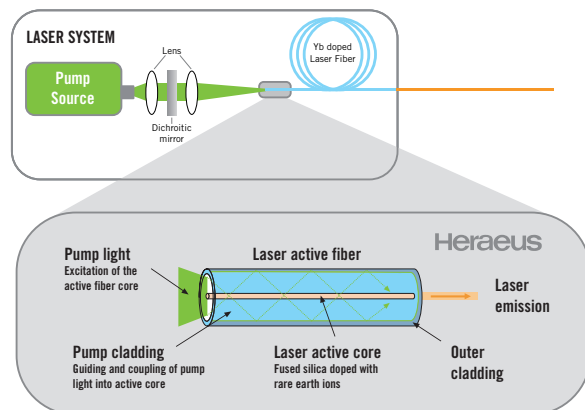
## Fiber Laser Solutions

There has been a rapid development of fiber lasers and their applications within the last decade. One major task is to further increase the laser power output.

Our material is the material of choice if it comes to bridge the gap between lower beam quality direct diode lasers and highest performance single mode fiber laser systems.

The key features of our material are the large batch size in combination with excellent material homogeneity as well as reproducible and well adjustable doping levels. Those enable novel fiber designs like extra-large mode multi kW laser system or multi core fiber structures.

Several important factors influence the performance of the final laser fiber, e.g. cross section design, refractive index tailoring, interface quality and material. Heraeus is your reliable partner on each step, from the bulk material over the custom tailored laser fiber preform to the final fiber.



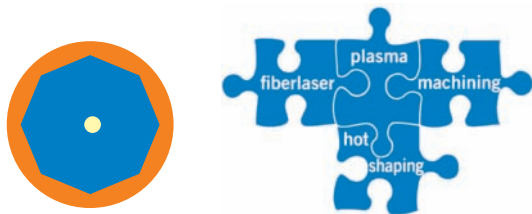
## Heraeus Opens a New Field of Fiber Designs

Heraeus has a more than 100 years tradition in adjusting quartz materials to our customers' needs. We used our long lasting know how on doping quartz materials to develop a new technology for rare earth doped fused silica for active laser fibers. This new technology is based on broad knowledge about doping fused silica, plasma outside deposition and core materials for passive fiber preforms for high power laser systems.

When it comes to large batch sizes for active laser materials most common processes like MCVD combined with solution doping come to their limits concerning geometry, batch size and homogeneity. Our proprietary technology overcomes these limitations and enables novel designs like extra-large mode area (XLMA) multi-mode double cladding laser fibers with an active core diameter of 40µm or above. We can supply you with active core material, preforms and also the final fiber based on requirements.

## Your Idea – Our Toolbox

With our long term experience and variety of well established processes we are able to realize also complex fiber designs. A combination of different technologies such as machining, jacketing, plasma outside deposition and different doped and un-doped material is available in house to end up with the design you wish in the quality you need.



## Doping Elements and Level

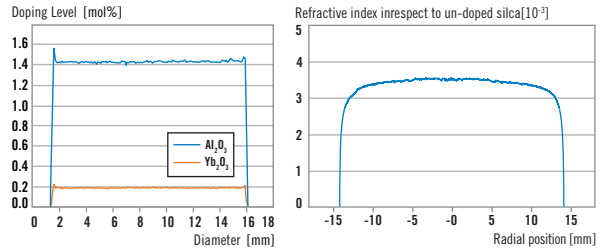
Our proprietary process enables us to adjust the doping levels and doping elements custom tailored on the requirements of the final laser fiber and can be defined very precisely. Our current standard dopants are Ytterbium and Aluminum, others are available on request.

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## Excellent Homogeneity and Reproducibility

Based on our doping process we achieve an excellent homogeneous doping and refractive index profile with extremely low radial and axial gradients even in large batch sizes to overcome the typical limitation of rare earth doped MCVD materials. This enables a reliable laser fiber quality either for XLMA designs or for large fiber batches.

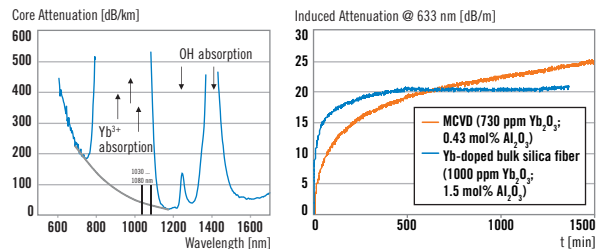


## Attenuation Properties

To achieve lowest attenuation levels highest purity starting materials are a must have. Heraeus has a long tradition on highest purity fused silica materials which are used e.g. for high power laser transmission in industrial lasers. Fibers made of our Yb-doped bulk material show a base attenuation at 1200 nm of 0.02 dB/m and a background attenuation at the laser wavelength between 1030 nm and 1080 nm of 0.02 ... 0.07 dB/m.

## Attenuation and Photostability

Regarding the photostability of Yb-doped laser fiber materials one main influence is the concentration of Yb-ions. With increasing the active core cross section like in XLMA fibers the concentration can be reduced which has a positive effect on the photo stability of the final fiber. A comparison of our material with a similar doped MCVD preform in a rapid damage testing setup is shown in the graph below.



## About us

Heraeus is the key global supplier of high purity synthetic fused silica products for optical fiber manufacturing. We have been a reliable partner in the world telecommunications industry since 1976.

We are certified for ISO 9001:2000 and our Total Quality Management system is based on the Business Excellence Model of the European Foundation for Quality Management (EFQM).