

Silica and fluoride glass fiber research and development for high power laser and optronic applications



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Silica-based optical fibers have long been used in the development of fiber lasers and amplifiers due to their excellent transparency, mechanical strength and compatibility with existing fiber technologies. Rare-earth (RE) doped silica fibers including Er^{3+} , Tm^{3+} , Yb^{3+} , and Ho^{3+} are of particular interest for industrial applications due to their ability to deliver high output power with excellent beam quality. However, in recent years, the growing demand for high-power lasers in the kilowatt range and operating in the short-wavelength infrared (SWIR) wavelength range at $2\ \mu\text{m}$ has highlighted the need for the development of specialty silica fibers that are currently not available on the market.

For other optronic applications, however, silica-based fibers exhibit limitations such as a restricted transmission window in the upper SWIR beyond $2.1\ \mu\text{m}$ and towards the mid-IR beyond

$3\ \mu\text{m}$. To overcome these limitations, active and passive fluoride glass fibers have been developed. Their lower phonon energy and greater transparency in the mid-IR range makes them an excellent candidate for mid-IR fiber lasers. Active fluoride fibers can also be fabricated by doping with rare-earth ions such as Er^{3+} , Ho^{3+} and Tm^{3+} . The doping concentration of RE ions in fluoride glasses can be higher than in silicates, which allows for specific optical signal emission and amplification.

At the Fraunhofer IOSB site in Oberkochen, our mission is to advance the research and development of doped and structured optical fibers. With the launch of our new facility, Fraunhofer IOSB possesses the capability to produce next-generation, custom-designed silica-based fibers tailored for high-energy laser applications as well as passive and active fluoride glass fibers to generate wavelengths in



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Fig. 1: Spooled fiber and three different fiber preforms from the fiber drawing process.