

## **Rare-Earth doped fluoride Glass Fibers: active applications**

Mohammed Saad and Robert M. Pafchek

*Thorlabs Inc. 56 Sparta Avenue, Newton, NJ 07860 USA*

[msaad@thorlabs.com](mailto:msaad@thorlabs.com)

### **Abstract**

Since the demonstration of the first fiber laser using rare-earth doped silica fiber in 1961 by Snitzer et al., fiber lasers have experienced extraordinary development. This is due to multiple advantages that fiber lasers have compared to other laser technologies such as semiconductor, gas and solid state lasers. Fiber lasers are compact and have high efficiency, excellent beam quality and have good heat dissipation capability. They are currently used in many industrial (drilling, cutting and welding...) and high tech applications, such as defense and aerospace, medicine, spectroscopy and sensing. Two research avenues have been investigated, output power scaling and new laser wavelengths.

Many glass hosts can incorporate rare-earth ions for active applications, such as Silica, Fluoride, Chalcogenide, Tellurite, and phosphate glasses. There is no single host material that can fulfill all fiber laser application needs. One has to select the right host for the right application.

The right candidate has to combine the ability to be drawn into high quality single mode optical fibers, high solubility of rare-earth ions, ability to write Bragg Gratings, ability to be cleaved and spliced and shows wide transmission window.

Silica and fluoride glasses combine all these parameters. However, Fluoride glasses have lower phonon energy, and consequently a wider transmission window than silica glasses. In addition they have a higher solubility of rare-earth ions. In some cases only few centimeters of doped fibers are needed to make a laser with few tens of mW output. Fiber lasers have been demonstrated using rare earth doped fluoride glass fiber operating from the ultra-violet to 4 microns in the mid-infrared.

The presentation will highlight fluoride fiber technology development. We will also highlight significant achievement in rare-earth doped fluoride fiber for fiber amplifiers and fiber lasers.