

3D printed transducers and sensors based on fiber Bragg gratings

Two students/project:

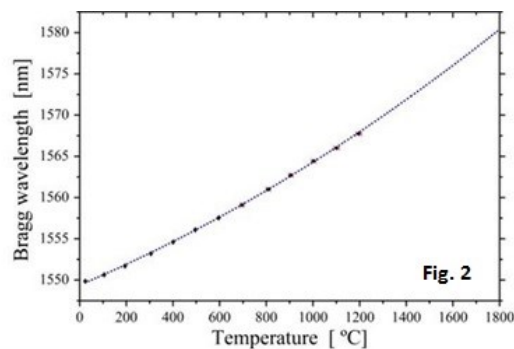
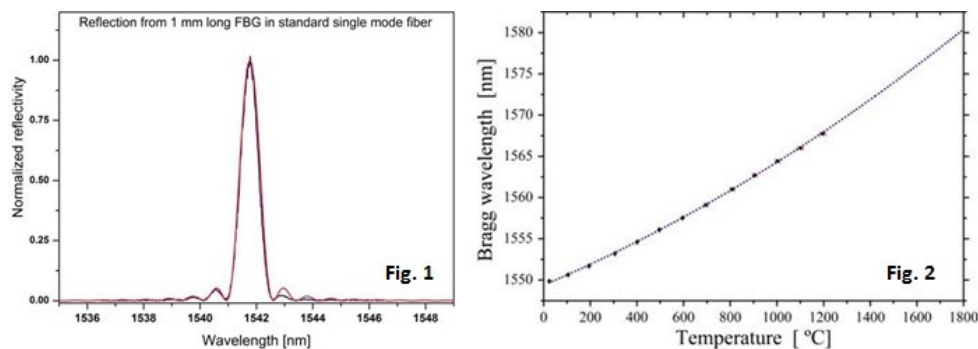
Projects available: 1-2

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The outcome of the project is to design (CAD), 3D print, and demonstrate a sensor or transducer using optical fiber.

Optical fibers developed for telecommunications and are today increasingly being used as miniature optical sensors. For many applications optical fibers provide an attractive solution due to the small size (125 μm in diameter), lightness, immunity to electric-magnetic interference (EMI), and multiplexing capabilities. Sensor applications using optical fibers range from measuring temperature in power plants, monitoring vibrations in airplanes, to security/alarm systems.

An example of optical fiber sensor is based on fiber Bragg gratings (FBG), manufactured by periodic irradiation of the optical fiber core using ultra-violet laser light. The result is a periodic change in the refractive and functions as a very narrow bandwidth mirror only reflecting light with a specific wavelength. A typical reflection spectrum of an FBG is shown in Fig. 1. If we heat the fiber and FBG, the refractive index changes due to the thermo-optic effect and the grating period changes due to the thermal expansion causes the grating wavelength to change (Fig. 2). Temperature readings can then be performed by monitoring the position of the Bragg wavelength.



During the project the students will explore some of the basics of optical fiber based components, FBGs and fiber-based sensors, and to compare alternative techniques commonly used.

The goal of the project is to design (CAD) and build, using a 3D FDM printer, a optical fiber based transducer that can measure a specific property. The parameter to be monitored will be decided by the students and could be, e.g., temperature, strain, pressure, humidity, wind speed, vibrations, etc. An example is presented in Fig. 3, showing a 3D printed FBG based transducer with optical connector used for monitoring temperature.