Bragg Grating Based Sensors in Microstructured Polymer Optical Fibers: Accelerometers and Microphones

**Bragg Grating Based Sensors in Microstructured Polymer Optical Fibers: Accelerometers and Microphones**

With the growing interest towards fiber Bragg grating sensors and the growing ability in manufacturing polymer optical fibers, the development of polymer fiber Bragg sensors has caught the attention of industries with the goal of developing high performance sensors.

This thesis presents the development of fiber sensors based on polymer optical fiber Bragg gratings. The whole process from the preform to the device is discussed and reported. A presentation on the fiber drawing technique used is given. Issues encountered when working with polymer fibers and solutions concerning fiber cleaving and gluing of polymer to silica fibers are discussed. The realization of gratings in polymer fibers is shown with two different techniques: the UV phase mask technique and the direct writing technique reported here for the first time for polymer fibers. Realization of gratings in PMMA step index fibers and in microstructured fibers made of PMMA and TOPAS is reported. The gratings have been written at both 1550 nm, to take advantage of components made for telecommunications, and 850 nm, to exploit the lower loss of polymers and the fast acquisition electronics at this wavelength. A technique for writing multiplexed gratings is shown and temperature compensation of strain sensors, by using two adjacent gratings, is demonstrated. Humidity insensitivity in a strain sensor based on a TOPAS fiber is also shown.

In order to investigate the possibility of using viscoelastic materials, such as polymers, in dynamic sensors, dynamic mechanical characterization of polymer fibers was made and it is presented.

The investigated and produced fiber Bragg gratings in microstructured polymer optical fibers were used to produce optical accelerometers. The accelerometers and their characterization are reported. Finally, the realization of an optical microphone based on polymer fiber Bragg gratings is reported.

**General information**

State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors & Supercontinuum
Contributors: Stefani, A., Bang, O., Yuan, S. W.
Number of pages: 125
Publication date: 2011

**Publication information**

Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Electronic versions:
Alessio_Stefani_PhD_Thesis_pdf.pdf
Research output: Research › Ph.D. thesis – Annual report year: 2012