Dynamic mechanical characterization with respect to temperature, humidity, frequency and strain in mPOFs made of different materials

This paper presents a dynamic mechanical analysis (DMA) of polymer optical fibers (POFs) to obtain their Young modulus with respect to the variation of strain, temperature, humidity and frequency. The POFs tested are made of polymethyl methacrylate (PMMA), Topas grade 5013, Zeonex 480R and Polycarbonate (PC). In addition, a step index POF with a core composed of Topas 5013 and cladding of Zeonex 480R is also analyzed. Results show a tradeoff between the different fibers for different applications, where the Zeonex fiber shows the lowest Young modulus among the ones tested, which makes it suitable for high-sensitivity strain sensing applications. In addition, the fibers with Topas in their composition presented low temperature and humidity sensitivity, whereas PMMA fibers presented the highest Young modulus variation with different frequencies. The results presented here provide guidelines for the POF material choice for different applications and can pave the way for applications involving the combination of different polymer materials.
Fast and stable gratings inscription in POFs made of different materials with pulsed 248 nm KrF laser

This paper presents fiber Bragg grating (FBG) inscription with a pulsed 248 nm UV KrF laser in polymer optical fibers (POFs) made of different polymers, namely polymethyl methacrylate (PMMA), cyclic-olefin polymer and co-polymer, and Polycarbonate. The inscribed gratings and the corresponding inscription parameters are compared with grating inscribed in POFs made of the aforementioned materials but with the hitherto most used laser for inscription, which is a continuous wave 325 nm UV HeCd laser. Results show a reduction of the inscription time of at least 16 times. The maximum time reduction is more than 130 times. In addition, a reflectivity and a bandwidth close to or higher than the ones with the 325 nm laser were obtained. The polymer optical fiber Bragg gratings (POFBGs) inscribed with the 248 nm laser setup present high stability with small variations in their central wavelength, bandwidth, and reflectivity after 40 days.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Manufacturing Engineering, Universidad Politecnica de Valencia, University of Espirito Santo, Universidade de Aveiro
Authors: Marques, C. A. (Ekstern), Min, R. (Ekstern), Leal, A. (Ekstern), Antunes, P. (Ekstern), Fasano, A. (Intern), Woyessa, G. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Ortega, B. (Ekstern), Bang, O. (Intern)
Pages: 2013-2022
Publication date: 22 Jan 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Optics Express
Volume: 26
Issue number: 2
ISSN (Print): 1094-4087
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.487 SNIP 1.589
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.976 SNIP 1.755 CiteScore 3.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.349 SNIP 2.166 CiteScore 4.18
Web of Science (2014): Indexed yes
Flow and breakup in extension of low-density polyethylene

The breakup during the extension of a low-density polyethylene Lupolen 1840D, as observed experimentally by Burghelea et al. (J Non-Newt Fluid Mech 166:1198–1209 2011), was investigated. This was observed during the extension of an circular cylinder with radius $R_0 = 4$ mm and length $L_0 = 5$mm. The sample was attached to two flat end plates, separated exponentially in time to extend the samples. A numerical method based on a Lagrangian kinematics description in a continuum mechanical framework was used to calculate the extension of an initially cylindrically shaped sample with and without small long-waved and centrally located suppression in the surface. The flow properties of the branched polymer
melt were defined by a multi mode version of the molecular stress function constitutive equation. A multi mode version based on a Maxwell relaxation spectrum was applied, and the involved parameters were fitted based on previous measured extensional viscosities including the startup, relaxed and reversed flow of the Lupolen 1840D melt. For an ideal cylindrically shaped geometry, at some of the extensional rates, there was a match with the calculated break of strain values, but most were just below the error bars as reported experimentally by Burghelea et al. (J Non-Newton Fluid Mech 166:1198–1209 2011). At low extensional rates, the measurements were considerably above the calculated ones. A very small relative suppression in the surface (0.1%) was required to achieve an agreement with all measurements on average. The largest sensitivity to the surface suppression was at low extensional rates.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Rasmussen, H. (Intern), Fasano, A. (Intern)
Pages: 317-325
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Rheologica Acta
Volume: 57
Issue number: 4
ISSN (Print): 0035-4511
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.9 SJR 0.61 SNIP 1.035
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.883 SNIP 1.307 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.725 SNIP 1.197 CiteScore 1.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.873 SNIP 1.397 CiteScore 2.09
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.909 SNIP 1.379 CiteScore 1.8
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.298 SNIP 1.428 CiteScore 2.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.272 SNIP 1.318
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.987 SNIP 1.236
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.898 SNIP 1.326
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.944 SNIP 1.307
Scopus rating (2006): SJR 0.899 SNIP 1.234
A third order accurate Lagrangian finite element scheme for the computation of generalized molecular stress function fluids

A third order accurate, in time and space, finite element scheme for the numerical simulation of three-dimensional time-dependent flow of the molecular stress function type of fluids in a generalized formulation is presented. The scheme is an extension of the K-BKZ Lagrangian finite element method presented by Marín and Rasmussen (2009).

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Fasano, A. (Intern), Rasmussen, H. K. (Intern)
Pages: 10-20
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Non-Newtonian Fluid Mechanics
Volume: 246
ISSN (Print): 0377-0257
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.43 SJR 1.079 SNIP 1.555
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.158 SNIP 1.496 CiteScore 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.986 SNIP 1.342 CiteScore 1.96
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.023 SNIP 1.618 CiteScore 2.09
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.112 SNIP 1.544 CiteScore 1.93
Low Loss Polycarbonate Polymer Optical Fiber for High Temperature FBG Humidity Sensing

We report the fabrication and characterization of a polycarbonate (PC) microstructured polymer optical fiber (mPOF) Bragg grating (FBG) humidity sensor that can operate beyond 100°C. The PC preform, from which the fiber was drawn, was produced using an improved casting approach to reduce the attenuation of the fiber. The fiber loss was found reduced by a factor of two compared to the latest reported PC mPOF [20], holding the low loss record in PC based fibers. PC mPOFBG was characterized to humidity and temperature, and a relative humidity (RH) sensitivity of 7.31±0.13 pm/% RH in the range 10–90% RH at 100°C and a temperature sensitivity of 25.86±0.63 pm/°C in the range 20–100 °C at 90% RH were measured.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Fasano, A. (Intern), Markos, C. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 575-578
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: I E E E Photonics Technology Letters
Volume: 29
Issue number: 7
ISSN (Print): 1041-1135
Ratings:
BFI (2018): BFI-level 2
Fiber gratings, Temperature measurement, Optical fiber sensors, Annealing, Humidity measurement, Plastic optical fiber

DOIs:
10.1109/LPT.2017.2668524
Simultaneous measurement of temperature and humidity with microstructured polymer optical fiber Bragg gratings

A microstructured polymer optical fiber (mPOF) Bragg grating sensor system for the simultaneous measurement of temperature and relative humidity (RH) has been developed and characterized. The sensing head is based on two in-line fiber Bragg gratings recorded in a mPOF. The sensor system has a root mean square deviation of 1.04 % RH and 0.8 °C in the range 10 to 90% RH and 20 to 80 °C. The proposed sensor system is easy to fabricate, cheap and compact.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Chemical and Biochemical Engineering, CHEC Research Centre, The Hempel Foundation Coatings Science and Technology Centre (CoaST), Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Pedersen, J. K. M. (Intern), Fasano, A. (Intern), Nielsen, K. (Intern), Markos, C. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Number of pages: 4
Publication date: 2017

Host publication information
Title of host publication: 25th International Conference on Optical Fiber Sensors
Volume: 10323
Publisher: SPIE - International Society for Optical Engineering
Editors: Chung, Y., Jin, W., Lee, B., Canning, J., Nakamura, K., Yuan, L.
Article number: 103234T
Main Research Area: Technical/natural sciences
Conference: 25th International Conference on Optical Fiber Sensors, Jeju, Korea, Republic of, 24/04/2017 - 24/04/2017
Polymer waveguides, Fiber Bragg gratings, Fiber optics sensors, Humidity, Temperature
Electronic versions:
103234T.pdf
DOIs:
10.1117/12.2265884

Solution-Mediated Annealing of Polymer Optical Fiber Bragg Gratings at Room Temperature

In this letter, we investigate the response of poly(methylmethacrylate) (PMMA) microstructured polymer optical fiber Bragg gratings (POFBGs) after immersion in methanol/water solutions at room temperature. As the glass transition temperature of solution-equilibrated PMMA differs from the one of solvent-free PMMA, different concentrations of methanol and water lead to various degrees of frozen-in stress relaxation in the fiber. After solvent evaporation, we observe a permanent blue-shift in the grating resonance wavelength. The main contribution in the resonance wavelength shift arises from a permanent change in the size of the fiber. The results are compared with conventional annealing. The proposed methodology is cost-effective as it does not require a climate chamber. Furthermore, it enables an easy-to-control tuning of the resonance wavelength of POFBGs.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Janting, J. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 687-690
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Photonics Technology Letters
Volume: 29
Issue number: 8
ISSN (Print): 1041-1135
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.52 SJR 1.018 SNIP 1.279
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.263 SNIP 1.327 CiteScore 2.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.461 SNIP 1.614 CiteScore 2.78
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.487 SNIP 1.547 CiteScore 2.95
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.623 SNIP 1.706 CiteScore 2.46
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.51 SNIP 2.012 CiteScore 2.48
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.474 SNIP 1.623
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.775 SNIP 1.804
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.081 SNIP 1.818
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.345 SNIP 1.566
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.112 SNIP 1.884
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.97 SNIP 2.454
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 3.286 SNIP 2.716
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 3.44 SNIP 2.467
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 3.566 SNIP 2.117
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 3.519 SNIP 1.678
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 2.345 SNIP 1.202
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.44 SNIP 1.302
Original language: English
Annealing, Plastic optical fiber, Optical fiber sensors, Bragg gratings, Polymers, Absorption
DOIs:
10.1109/LPT.2017.2678481
Publication: Research - peer-review › Journal article – Annual report year: 2017
Zeonex microstructured polymer optical fiber: fabrication friendly fibers for high temperature and humidity insensitive Bragg grating sensing

In the quest of finding the ideal polymer optical fiber (POF) for Bragg grating sensing, we have fabricated and characterized an endlessly single mode microstructured POF (mPOF). This fiber is made from cyclo-olefin homopolymer Zeonex grade 480R which has a very high glass transition temperature of 138 °C and is humidity insensitive. It represents a significant improvement with respect to the also humidity insensitive Topas core fibers, in that Zeonex fibers are easier to manufacture, has better transmittance, higher sensitivity to temperature and better mechanical stability at high temperature. Furthermore, Zeonex has very good compatibility with PMMA in terms of dilatation coefficients for co-drawing applications. The Zeonex mPOF has a core and cladding diameter of 8.8 µm and 150 µm, respectively, with a hole to pitch ratio of 0.4 and a minimum propagation loss of 2.34 ± 0.39 dB/m at 690.78 nm. We have also inscribed and characterized fiber Bragg gratings (FBGs) in Zeonex mPOFs in the low loss 850 nm spectral band.

Zeonex-PMMA microstructured polymer optical FBGs for simultaneous humidity and temperature sensing

In this Letter, we report for the first time, to the best of our knowledge, the fabrication and characterization of a Zeonex/PMMA microstructured polymer optical fiber (mPOF) Bragg grating sensor for simultaneous monitoring of relative humidity (RH) and temperature. The sensing element (probe) is based on two separate in-line fiber Bragg gratings (FBGs) inscribed in the fabricated mPOF. A root mean square deviation of 0.8% RH and 0.6°C in the range of 10%-90% RH and 20°C-80°C was found. The developed mPOFBG sensor constitutes an efficient route toward low-cost, easy-to-fabricate and compact multi-parameter sensing solutions.
3D-printed PMMA Preform for Hollow-core POF Drawing

In this paper we report the first, to our knowledge, 3D-printed hollow-core poly(methyl methacrylate) (PMMA) preform for polymer optical fibre drawing. It was printed of commercial PMMA by means of fused deposition modelling technique. The preform was drawn to cane, proving good enough quality of drawing process and the PMMA molecular weight to be appropriate for drawing. This ascertains that the manufacturing process provides preforms suitable for hollow-core fibre drawing. The paper focuses on maximisation of transparency of PMMA 3D printouts by optimising printing process parameters: nozzle temperature, printing speed and infill.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Aston University
Authors: Zubel, M. G. (Ekstern), Fasano, A. (Intern), Woyessa, G. (Intern), Sugden, K. (Ekstern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 6
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 25th International Conference on Plastic Optical Fibers 2016
Publisher: University of Aston in Birmingham
ISBN (Electronic): 9781854494085
Main Research Area: Technical/natural sciences
Electronic versions:
PP32.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Creation of a microstructured polymer optical fiber with UV Bragg grating inscription for the detection of extensions at temperatures up to 125°C

We describe the fabrication of a polycarbonate (PC) micro-structured polymer optical fiber (mPOF) and the writing offiber Bragg gratings (FBGs) in it to enable strain and temperature measurements. We demonstrate the photosensitivity ofa dopant-free PC fiber by grating inscription using a UV laser. We further show that PC Bragg gratings can be extendedup to at least 3% without affecting the initial functionality of the micro-structured fiber. The response of PC FBGs to temperature up to 125°C is also investigated. Polycarbonate has good mechanical properties and its high temperatureresistancemight extend the range of application of polymeric FBGs.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Federal Institute for Materials Research and Testing
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Stajanca, P. (Ekstern), Markos, C. (Intern), Stefani, A. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Krebber, K. (Ekstern), Bang, O. (Intern)
Number of pages: 6
Here we present the fabrication of a solid-core microstructured polymer optical fiber (mPOF) made of polycarbonate (PC), and report the first experimental demonstration of a fiber Bragg grating (FBG) written in a PC optical fiber. The PC used in this work has a glass transition temperature of 145°C. We also characterize the mPOF optically and mechanically, and further test the sensitivity of the PC FBG to strain and temperature. We demonstrate that the PC FBG can bear temperatures as high as 125°C without malfunctioning. In contrast, polymethyl methacrylate-based FBG technology is generally limited to temperatures below 90°C.
Investigation of the in-solution relaxation of polymer optical fibre Bragg gratings

We investigate the response of PMMA microstructured polymer optical fibre Bragg gratings when immersed in methanol-water solutions. Overall we observe a permanent blue-shift in Bragg grating wavelength after solvent evaporation. The main contribution in the resonance wavelength shift probably arises from a permanent change in the size of the fibre, as already reported for high-temperature annealing of polymer optical fibres. As a consequence of the solution concentration dependence of the glass transition temperature of polymers, different methanol-water solutions lead to various degrees of frozen-in stress relaxation with an overall blue-shift of the Bragg grating wavelength.

Polymer Optical Fibre Bragg Grating Humidity Sensor at 100°C

We have demonstrated a polymer optical fibre Bragg grating humidity sensor that can be operated up to 100°C. The sensor has been fabricated from a polycarbonate (PC) microstructured polymer optical fibre Bragg grating (mPOFBG). PC mPOFBG gave a relative humidity (RH) sensitivity of 6.95±0.83 pm/% RH in the range 10-90% RH at 100°C and a temperature sensitivity of 25.94±0.47 pm/ºC in the range 20 - 100 ºC at 90% RH. Despite PC mPOFBGs shows smaller humidity sensitivity compared to PMMA mPOFBGs, they can be used to sense humidity beyond the operating temperature limit of PMMA mPOFBGs.
Single mode step-index polymer optical fiber for humidity insensitive high temperature fiber Bragg grating sensors

We have fabricated the first single-mode step-index and humidity insensitive polymer optical fiber operating in the 850 nm wavelength ranges. The step-index preform is fabricated using injection molding, which is an efficient method for cost effective, flexible and fast preparation of the fiber preform. The fabricated single-mode step-index (SI) polymer optical fiber (POF) has a 4.8µm core made from TOPAS grade 5013S-04 with a glass transition temperature of 134°C and a 150 µm cladding made from ZEONEX grade 480R with a glass transition temperature of 138°C. The key advantages of the proposed SIPOF are low water absorption, high operating temperature and chemical inertness to acids and bases and many polar solvents as compared to the conventional poly-methyl-methacrylate (PMMA) and polystyrene based POFs. In addition, the fiber Bragg grating writing time is short compared to microstructured POFs.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Fasano, A. (Intern), Stefani, A. (Intern), Markos, C. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 1253-1260
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Optics Express
Volume: 24
Issue number: 2
ISSN (Print): 1094-4087
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.487 SNIP 1.589
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.976 SNIP 1.755 CiteScore 3.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.349 SNIP 2.166 CiteScore 4.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.358 SNIP 2.226 CiteScore 4.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.587 SNIP 2.145 CiteScore 3.85
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.579 SNIP 2.606 CiteScore 4.04
We propose a solution doping method for polycarbonate (PC) and TOPAS polymer optical fibre (POF) canes using different UV photosensitive dopants aiming to reduce the fibre Bragg grating inscription time at the typical Bragg grating inscription wavelength (325nm). Three-ring solid-core PC mPOF canes and hollow-core TOPAS canes were doped with a solution of dopants in acetone/methanol and hexane/methanol, respectively. Doping time, solvent mixture concentration and doping temperature were optimised. A long and stepwise drying process was applied to the doped canes to ensure complete solvent removal. This is required to avoid the formation of any bubbles during the fibre drawing process.

**General information**

State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering, Maria Curie-Sklodowska-University
Pages: 264-268
Publication date: 2016

**Host publication information**

Title of host publication: Proceedings of the 25th International Conference on Plastic Optical Fibers 2016
Zeonex Microstructured Polymer Optical Fibre Bragg Grating Sensor

We fabricated an endlessly single mode and humidity insensitive Zeonex microstructured polymer optical fibre (mPOF) for fibre Bragg grating (FBG) temperature and strain sensors. We inscribed and characterise FBGs in Zeonex mPOF for the first time.

3D Viscoelastic Finite Element Modelling of Polymer Flow in the Fiber Drawing Process for Microstructured Polymer Optical Fiber Fabrication

The process of drawing an optical fiber from a polymer preform is still not completely understood, although it represents one of the most critical steps in the process chain for the fabrication of microstructured polymer optical fibers (mPOFs). Here we present a new approach for the numerical modelling of the fiber drawing process using a fully three-dimensional and time-dependent finite element method, giving significant insight into this widely spread mPOF production technique. Our computational predictions are physically based on the viscoelastic fluid dynamics of polymers. Until now the numerical modelling of mPOF drawing has mainly been based on principles, such as generalized Newtonian fluid dynamics, which are not able to cope with the elastic component in polymer flow. In the present work, we employ the K-BKZ constitutive equation, a non-linear single-integral model that combines both elastic and viscous ideas and can appropriately describe the physics of polymers under processing.

3D Viscoelastic Finite Element Modelling of Polymer Flow in the Fiber Drawing Process for Microstructured Polymer Optical Fiber Fabrication

The process of drawing an optical fiber from a polymer preform is still not completely understood, although it represents one of the most critical steps in the process chain for the fabrication of microstructured polymer optical fibers (mPOFs). Here we present a new approach for the numerical modelling of the fiber drawing process using a fully three-dimensional and time-dependent finite element method, giving significant insight into this widely spread mPOF production technique. Our computational predictions are physically based on the viscoelastic fluid dynamics of polymers. Until now the numerical modelling of mPOF drawing has mainly been based on principles, such as generalized Newtonian fluid dynamics, which are not able to cope with the elastic component in polymer flow. In the present work, we employ the K-BKZ constitutive equation, a non-linear single-integral model that combines both elastic and viscous ideas and can appropriately describe the physics of polymers under processing.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Fasano, A. (Intern), Markos, C. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 2
Publication date: 2016
Humidity insensitive step-index polymer optical fibre Bragg grating sensors

We have fabricated and characterised a humidity insensitive step index (SI) polymer optical fibre (POF) Bragg grating sensors. The fibre was made based on the injection molding technique, which is an efficient method for fast, flexible and cost effective preparation of the fibre preform. The fabricated SIPOF has a core made from TOPAS with a glass transition temperature of 134 degrees C and a cladding from ZEONEX with a glass transition temperature of 138 degrees C. The main advantages of the proposed SIPOF are the low water absorption and good chemical resistance compared to the conventional poly-methyl-methacrylate (PMMA) based SIPOFs. The fibre has a minimum loss of similar to 6dB/m at 770nm.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering, Department of Management Engineering
Authors: Woyessa, G. (Intern), Fasano, A. (Intern), Stefani, A. (Intern), Markos, C. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Number of pages: 4
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SPIE
Volume: 9634
Publisher: SPIE - International Society for Optical Engineering
Article number: 96342L
ISBN (Print): 9781628418392
Series: Proceedings of the SPIE - The International Society for Optical Engineering
Volume: 9634
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
Conference: 24th International Conference on Optical Fibre Sensors, Curitiba, Brazil, 28/09/2015 - 28/09/2015
ENGINEERING, OPTICS, PHYSICS,, FEW-MODE, TOPAS, FABRICATION, Injection molding, Fibre fabrication, Polymer optical fibre, Fibre Bragg grating, Fibre optic sensor
Electronic versions: 96342L.pdf
DOIs:
10.1117/12.2194963

Bibliographical note
Copyright 2015 Society of Photo Optical Instrumentation Engineers. One print or electronic copy may be made for personal use only. Systematic electronic or print reproduction and distribution, duplication of any material in this paper for a fee or for commercial purposes, or modification of the content of the paper are prohibited.
Source: FindIt
Source-ID: 2288032553
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015

Production and Characterization of Polycarbonate Microstructured Polymer Optical Fiber Bragg Grating Sensor

We present the fabrication and characterization of a polycarbonate (PC) microstructured polymer optical fiber (mPOF) and the writing of a fiber Bragg grating (FBG) in it to obtain a polymer optical FBG sensor. The manufacturing process of the PC mPOF consists of multiple consecutive stages, such as casting of polymer granulates into a solid rod, machining and drilling of a 3-ring hexagonal lattice of holes into it, and finally drawing into fiber. We demonstrate that the obtained PC mPOF is photosensitive and FBGs can be conveniently inscribed into it, thereby enabling FBG-based temperature and strain sensing. The PC optical fibers are for some applications an attractive alternative to conventional materials used in POF fabrication, such as polymethyl methacrylate (PMMA). In general, PC can be used at temperature up to 120 °C and breaks at considerably higher strains than PMMA.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Federal Institute for Materials Research and Testing
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Stajanca, P. (Ekstern), Markos, C. (Intern), Stefani, A. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Krebber, K. (Ekstern), Bang, O. (Intern)
Number of pages: 4
Publication date: 2015
We propose a process for Polymer Optical Fiber (POF) Compound Parabolic Compound (CPC) tip manufacturing using a heat and pull fiber tapering technique. The POF, locally heated above its glass transition temperature, is parabolically tapered down in diameter, after which it is cut to the desired output diameter and finally polished to obtain the special CPC tip. The physical mechanism responsible for giving a CPC shape to the POF tip is also investigated. The fabrication process is shown to be sensitive to several manufacturing parameters, such as temperature of the heat source, thermal flux from the heat source, and heating time. We further consider the influence of the heating time latter parameter on the geometry of the obtained CPC fiber tips.