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ANGADI INSTITUTE OF TECHNOLOGY & MANAGEMENT
(An Integrated Campus)
Savagaon Road, BELGAUM-590 009, KARNATAKA
(Affiliated to Visvesvaraya Technological University, Belgaum)
(APPROVED BY AICTE, NEW DELHI)
DEPARTMENT OF PHYSICS

Dr. VIJAY K. KULKARNI
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Professor & Head

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21-08-2020

Letter of Research Collaboration

From,
Dr.Vijay K.Kulkarni
Prof & Head
Department of Physics
Angadi Institute of Technology and management
Belagavi 590 009
Karnataka State

To
Dr Mangesh S. Jadhav
Dept of Physics
J. S. S. Arts, Science and Commerce College,
Gokak (Karnataka) India

Our Physics department is recognized as Research Centre by Visvesvaraya Technological University, Belagavi in 2014-15 for perusing Ph.D. in Physics and to carryout research work. Four research students have enrolled for Ph.D. under my supervision with this research centre. I am keen to have research collaboration with Dr Mangesh S. Jadhav on Fiber optics and material science.

It would be great advantage for both the colleges to have research activity in the field of Fiber optics and material science for the beneficiary of research students, research proposal submission and exchange of research concepts.

I look forward to working with you in future.

Sincerely,
21/8/2020

(Dr.Vijay K.Kulkarni)
Research Centre Head
Head of the Department
Department of Physics
AITM, Belagavi-09.

Co-ordinator, IQAC
J.S.S. Arts, Science & Commerce, College, Gokak.

GOKAK
J.S.S. Arts Sc. Comm. Degree & P.G. College

PRINCIPAL
J.S.S. ARTS, SCIENCE AND COMMERCE COLLEGE, GOKAK

Department of Collegiate Education
Smt. I. S. Yadawad Government First Grade College, Ramdurg
(NAAC Accredited 'B' Grade)

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Date: 28/12/2019

Letter of Research Collaboration

It indeed a great pleasure for collaborating our college Department of Physics with the Department of Physics, J. S. S Arts, Science and Commerce college Gokak, to carry out the research activity in the field of fiber optics, material science and spectroscopy for the beneficiary of the students, research proposal submission and exchange of research concepts.

PRINCIPAL
Smt. I. S. Yadawad Govt. First
Grade College, Ramdurg.

Co-ordinator, IQAC
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Commerce, College, Gokak.

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COMMERCE COLLEGE, GOKAK

International Journal of Engineering Applied Sciences and Technology, 2021
Vol. 6, Issue 3, ISSN No. 2455-2143, Pages 122-126
Published Online July 2021 in IJEAST (http://www.ijeast.com)

HIGHLY SENSITIVE DETECTION OF LEAD IONS IN WATER USING ETCHED FBG

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Abstract - Lead is a soft, ductile, malleable and naturally present in earth's crust. Lead is highly toxic element affects living organism even at lower concentration. Lead is used in many industries and its disposable is very difficult. Therefore, it may lead to various environmental hazardous problems. World Health Organization (WHO) and other organisation specify the presence of lead in drinking water not greater than 20 ppb. In the present work, a simple, affordable and precise way to detect the concentration of lead in water using Fibre Bragg gratings (FBG) is presented. FBG are formed using Phase mask technique and the cladding part over the grating region is etched with 40% Hydrofluoric acid (HF) solution. The sensor so developed is sensitive enough to find the presence of lead in water in the range 5-25 ppb.

Keywords: Fibre Bragg grating, Etching, Lead, sensor, ppb.

I. INTRODUCTION

Lead poisoning seems to be one of the major causes for critical health concern across world. It has been treated as one of the most harmful metal concern with public health environment[1,2]. Pollution caused due to heavy metals like mercury, arsenic, lead, copper, fluoride, zinc, chromium and many more which leads to major health issues in humans and animals[3,4]. It enters in the living system through ingestion of contamination in water and food materials[5–9]. As lead is not present in drinking water unless it is being contaminated during the transportation through metal pipes, PVC pipes and even through corrosion of plumbing material and solder, which may contain lead. The quantity of lead in water may even depends on the ages of pipes, duration of water present in such pipes, minerals present in water, temperature and pH level of water[10,11].

Techniques reported various measurements in connection with identifying the presence of lead in water. The most common method is utilising the atomic absorption spectrometry technique and with this method most accurate measurement can be recorded[12,13]. The other methods reported are through Fluorescent technique and using optical fibres [5,14,15].

II. THEORY AND WORKING PRINCIPLE OF FBG SENSOR

Bragg gratings have great potential to operate in wavelength of 1350/1550 nm in optical communication system and such gratings are fabricated by exposing them to UV source. FBG are a sort of periodic variation in refractive index of core in a single mode photosensitive optical fibre [16].

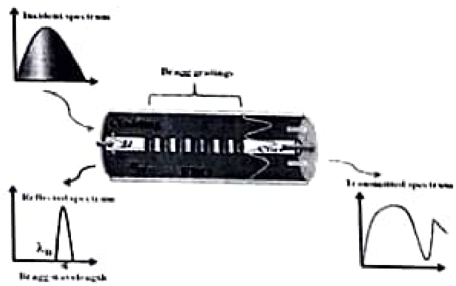

Fig.1. The transmitted / reflected spectra of fiber grating.

The grating fabrication is carried out by the phase mask technique[7]. When a broad band source is connected to the one end of the FBG, we observe a narrow band of spectrum is reflected

IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

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HYDROGEN PEROXIDE CONCENTRATION SENSOR USING FIBER BRAGG GRATING

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Abstract: The concentration measurements of various solutions are of great interest in many of industrial processes as a mean of quality production control. In this paper the Fiber Bragg Grating is fabricated by phase mask technique on single mode Ge-B co-doped photosensitive fiber with KrF (248 nm) source. The grating region etched with HF (40%) to act as a concentration sensor, which affects the resonance wavelength with change in surrounding media (hydrogen peroxide) concentration. We have analyzed hydrogen peroxide for various low level concentrations in the range of 1-12 ppm level. The sensor acts effectively sensitive to small changes in hydrogen peroxide concentration.

Index Terms: Fiber Bragg Grating, hydrogen peroxide, Sensor, optical spectrum analyzer

I. INTRODUCTION

The research field in optical fiber grating technology has opened a new platform in both communication and sensor field. These fiber optics have originally developed to multiple signals in optical networks and are now being widely used in the field of sensors, such as to measure strain, temperature, pressure and as a chemical sensor [1-3].

The fiber gratings are classified as Long period grating (LPG) and Fiber Bragg gratings (FBG) depending on their grating period. The grating period in LPG is of the order of more than 100 µm, where as in FBG it is of the order of less than 1µm [4]. The FBG is a periodic modulation in refractive indices of the core of the fiber. When a broadband light is connected to FBG a narrow band of wavelength centered at one certain particular wavelength known as Bragg wavelength λ_B is reflected. The FBG works on the principle of reflected wavelength λ_B and is given by

$$\lambda_B = 2n_{eff}\Lambda$$

Where n_{eff} is the effective refractive index of the core and Λ is grating period.

The reflected wavelength mainly depends on parameters like grating length, grating pitch and effective refractive index. When cladding region is reduced along the length of grating region, the n_{eff} is significantly affected by surrounding refractive index (SRI) [5]. By reducing the cladding part of fiber gratings can be made to act as chemical sensor [6,7].

The chemical formula for hydrogen peroxide is H_2O_2 The hydrogen peroxide ion consists of a single bond between two oxygen atoms. Hydrogen peroxide solution appears like water and it can be dissolved in water unrestrainedly. When compared with water molecule hydrogen peroxide molecule contains one extra oxygen atom and its structural formula is H-O-O-H. Hydrogen peroxide is a strong oxidizer and acts as bleaching and sterilizing agent and is widely used in paper and textile industry for bleaching purpose. Hydrogen peroxide is used for processing food, minerals and petrochemicals. It is used in municipal water treatment and in cleaning of swimming pools. This is one of the waste products in atomic power station. Many of the methods like chemical, electrochemical and spectroscopy methods are adopted in finding the concentration of hydrogen peroxide in lower concentration [7,8]. We are presenting a FBG based fiber optic sensor to measure the concentration of hydrogen peroxide in lower range at ppm level.

JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DETERMINATION OF REFRACTIVE INDEX OF ETHANOL USING ETCHED FIBER BRAGG GRATING

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Abstract: In this present work, we have demonstrated the etched Fiber Bragg Grating as refractive index sensor. Using etched fiber, the dependence of the sensor sensitivity on surrounding refractive index in terms of wavelength shift and reflected output power variations are analyzed for ethanol. This type of sensors are applicable to many fields including chemical, biochemical, biomedical and environmental sensing.

Index Terms: fiber Bragg Grating, phase mask, refractive index sensor

I. INTRODUCTION:

Over the fast few years, the advancements in the optical fibers has undoubtedly improved and reshaped "fiber optic technology". In addition to applications in telecommunications, optical fibers are also utilized in the rapidly growing fields of fiber sensors, fiber lasers and fiber amplifiers. Despite the improvements in optical fiber manufacturing and advancements in the field in general, basic optical components such as mirrors, wavelength filters and partial reflectors have been a challenge to integrate with fiber optics. Recently, however, all these challenges are overcome, with the ability to alter the core index of refraction in a single mode optical fiber by optical absorption of UV light. This photosensitivity of optical fibers allows the fabrication of phase structures in the core of fibers. These phase structures or phase gratings are obtained by permanently changing the index of refraction in a periodic pattern along the core of the fiber. A periodic modulation of the index of refraction in the fiber core acts like a selective mirror for the wavelength that satisfies the Bragg condition [1]. It forms a Fiber Bragg grating (FBG).

Fiber Bragg Gratings (FBGs) have been used extensively in the telecommunication industry for dense wavelength division multiplexing, dispersion compensation, laser stabilization and erbium amplifier gain flattening. In addition, FBGs have been used for a wide variety sensing applications including temperature, strain and pressure measurement [2]. The main advantage of FBGs for sensing is that these devices perform a direct transformation of the sensed parameter to optical wavelength.

The principle of operation relies on the dependence of the Bragg resonance on effective refractive index and on the grating pitch. In standard optical fibers, effective refractive index is not influenced by the external one; thus no sensitivity to the surrounding refractive index (SRI) is expected. Etching the cladding at the region of the Bragg grating formation lets the evanescent field of the waveguided mode interact with the immediate surrounding environment of the fiber. When the fiber grating is immersed in a sample liquid, this result in a wavelength response of the Bragg grating that is affected by the refractive index of the solution to be measured.

The wavelength response of the Fiber Bragg Grating is measured from equation

$$\lambda_B = 2n_{eff}\Lambda$$

The sensitivity of sensor of this kind depends on the change in effective index n_{eff} for the wave-guide mode, which is related to the change in refractive index of the solution. The change in the effective index can be derived by using perturbation theory for three region fibers [2]. The perturbed propagation constant of the fundamental waveguide mode is then given by [3]

$$\beta = \beta_0 + \kappa\eta_p(n_0 - n_d)$$

Where $\beta_0 = (\frac{2\pi}{\lambda})n_{eff}$ is the propagation constant of the waveguide mode in the unperturbed fiber with $\kappa = \frac{2\pi}{\lambda}$, where λ is the free space wavelength. The refractive index of the environment outside the cladding is denoted by n_0 and the

IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

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Etched FBG Refractive Index sensor for Alcohols

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Abstract: *In this present work, we have demonstrated the etched Fiber Bragg Grating as refractive index sensor. Using etched fiber, the dependence of the sensor sensitivity on surrounding refractive index in terms of wavelength shift and reflected output power variations are analyzed for different alcohols. These types of sensors are applicable to many fields including chemical, biochemical, biomedical, industries and environmental sensing.*

Keywords: *fiber Bragg Grating, phase mask, refractive index sensor, Alcohols*

1. INTRODUCTION:

Over the fast few years, the advancements in the optical fibers has undoubtedly improved and reshaped "fiber optic technology". In addition to applications in telecommunications, optical fibers are also utilized in the rapidly growing fields of fiber sensors, fiber lasers and fiber amplifiers. Despite the improvements in optical fiber manufacturing and advancements in the field in general, basic optical components such as mirrors, wavelength filters and partial reflectors have been a challenge to integrate with fiber optics. Recently, however, all these challenges are overcome, with the ability to alter the core index of refraction in a single mode optical fiber by optical absorption of UV light. This photosensitivity of optical fibers allows the fabrication of phase structures in the core of fibers. These phase structures or phase gratings are obtained by permanently changing the index of refraction in a periodic pattern along the core of the fiber. A periodic modulation of the index of refraction in the fiber core acts like a selective mirror for the wavelength that satisfies the Bragg condition [1]. It forms a Fiber Bragg grating (FBG).

Fiber Bragg Gratings (FBGs) have been used extensively in the telecommunication industry for dense wavelength division multiplexing, dispersion compensation, laser stabilization and erbium amplifier gain flattening. In addition, FBGs have been used for a wide variety sensing applications including temperature, strain and pressure measurement [2]. The main advantage of FBGs for sensing is that these devices perform a direct transformation of the sensed parameter to optical wavelength.

The principle of operation relies on the dependence of the Bragg resonance on effective refractive index and on the grating pitch. In standard optical fibers, effective refractive index is not influenced by the external one; thus no sensitivity to the surrounding refractive index (SRI) is expected. Etching the cladding at the region of the Bragg grating formation, lets the evanescent field of the waveguided mode interact with the immediate surrounding environment of the fiber. When the fiber grating is immersed in a sample liquid, this result in a wavelength response of the Bragg grating that is affected by the refractive index of the solution to be measured.

The wavelength response of the Fiber Bragg Grating is measured from equation

$$\lambda_B = 2n_{eff}\Lambda$$

The sensitivity of sensor of this kind depends on the change in effective index n_{eff} for the wave-guide mode, which is related to the change in refractive index of the solution. The change in the effective index can be derived by using perturbation theory for three region fibers [2-3].

In the present work, the dependence of the sensor sensitivity on the surrounding refractive index (SRI) of alcohols in terms of wavelength shift analyzed. Sensor fabrication has been carried out by using photosensitive optical fiber and chemical etching in a hydrofluoric acid (HF). Finally experimental characterization of the sensor response to external refractive indices for the alcohols has been carried out by using optical spectrum analyzer. The spectral changes in the grating response due to variation of the SRI have been investigated leading to new sensing configurations.

Refractive Index sensor for Hydrogen Peroxide Using Fiber Bragg Grating

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Abstract: **In this present work, we have demonstrated the etched Fiber Bragg Grating as refractive index sensor for hydrogen peroxide. Using etched fiber, the dependence of the sensor sensitivity on surrounding refractive index in terms of wavelength shift and reflected output power variations are analyzed for hydrogen peroxide solution. These types of sensors are applicable to many fields including chemical and environmental sensing.**

Keywords: **fiber Bragg Grating, phase mask, hydrogen peroxide and refractive index Sensor.**

I. INTRODUCTION

In the recent years, the advancements in the fiber optics has certainly improved the"fiber optic technology". In addition to applications in telecommunications, optical fibers are also utilized in the rapidly growing fields of fiber sensors, fiber lasers and fiber amplifiers. In spite of the improvements in optical fiber manufacturing and advancements in the field in general, basic optical components such as mirrors, wavelength filters and partial reflectors have been a challenge to integrate with fiber optics. Recently, however, all these challenges are overcome, with the ability to alter the core index of refraction in a single mode optical fiber by optical absorption of UV light. This photosensitivity of optical fibers allows the fabrication of phase structures in the core of fibers. These phase structures or phase gratings are obtained by permanently changing the index of refraction in a periodic pattern along the core of the fiber. A periodic modulation of the index of refraction in the fiber core acts like a selective mirror for the wavelength that satisfies the Bragg condition [1]. It forms a Fiber Bragg grating (FBG). FBGs have been used for a wide variety sensing applications viz., temperature, strain and pressure measurement [2]. The major benefit of FBGs for sensing is that these devices perform a direct transformation of the sensed parameter to optical wavelength.

The principle of operation relies on the dependence of the Bragg resonance on effective refractive index and on the grating pitch. In standard optical fibers, effective refractive index is not influenced by the external one; thus no sensitivity to the surrounding refractive index (SRI) is expected. Etching the cladding at the region of the Bragg grating formation lets the evanescent field of the waveguided mode interact with the immediate surrounding environment of the fiber. When the fiber grating is immersed in a sample liquid, this result in a wavelength response of the Bragg grating that is affected by the refractive index of the solution to be measured.

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The sensitivity of sensor of this kind depends on the change in effective index n_{eff} for the wave-guide mode, which is related to the change in refractive index of the solution. The change in the effective index can be derived by using perturbation theory for three region fibers [2]. The perturbed propagation constant of the fundamental waveguide mode is then given by [3]

$$\beta = \beta_0 + \kappa\eta_p(n_0 - n_{cl})$$

Where $\beta_0 = (\frac{2\pi}{\lambda})n_{eff}$ is the propagation constant of the waveguide mode in the unperturbed fiber with $\kappa = \frac{2\pi}{\lambda}$, where λ is the free space wavelength. The refractive index of the environment outside the cladding is denoted by n_0 and the cladding index n_{cl} The factor η_p is the

JOURNAL OF OPTOELECTRONICS AND ADVANCED MATERIALS Vol. 24, No. 7-8, July – August 2022, p. 318 - 322

Highly sensitive fiber optics evanescent wave sensor for detection of zinc in water

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Optical fiber chemical sensors provide a promising solution for determination of contaminants elements like Zinc, present in drinking water in ppm level & are a big challenge in present scenario. In the present work, designed a multimode evanescent wave fiber optic chemical sensors have been reported for zinc detection. The whole experiment has been performed by fixing the fibers in a horizontal position with the sensor regions at the center of the fiber, making it less prone to disturbance and breaking. This experimental study explores the detection of zinc in water using multimode optical fiber and sensitivity shows that 0.0042 mW change in power per ppm for core mode and 0.228 mW changes in power per ppm for cladding mode. Variation in the refractive index of different concentration of sample (at ppm) leads to change in output power. The highly sensitive fiber optic evanescent wave sensors provide low-cost and most effective device for chemical species detection and widely used in various medical, biological and chemical applications.

(Received January 12, 2021; accepted August 10, 2022)

Keywords: Chemical sensor, Evanescent wave, Multimode fiber, Zinc

1. Introduction

In the recent decades the environment is being polluted by very hazardous materials [1]. It is directly affecting the living organism on earth. Zinc is one of the common elements found in the earth crust and increases acidity in water on addition. Zinc is one among them which naturally occurs in air, water and soil in nature [2]. Due to human activities the level of zinc is rising at alarm rate to disturb the ecological system. Zinc is available in drinking water and is safe, if it is consumed within range of 5 ppm specified by WHO. Consuming too much zinc into the body through food, water or dietary supplements can also affect human health [3–5]. If it is consumed with higher level may suffer with loss in taste, smell, decrease in hunger and also wound healing capacity may decreases. Acute toxicity arises from the ingestion of excessive amounts of zinc salts either accidentally or deliberately. Many chemical and spectroscopic methods are evolved to find the concentration of zinc in water [1-2, 6-7]. Here, we are presenting a simple and effective measurement technique using optical fiber sensor using evanescent wave absorption technique in detection of trace amount of zinc in water. Fiber optic sensor technology has shown an effective sensing mechanism as a various types of sensors; viz. strain, gas, temperature etc., due to its optical properties [7–12]. Optical fiber sensors have shown greater interest in the sensing technology due to its unique and effective property [13,14]. Fiber optic sensor principle is based on change in refractive index of the medium surrounding its core and the corresponding change can be studied due to the variation in the output power as well as in the wavelength of transmitted light. Surface Plasmon resonance (SPR) is very sensitive refractive index based technique is widely used as detection principle for many sensors that operates at different areas [15]. So far, fiber optic sensors have shown enormous applications in measurement for various parameters [16–18]. Fiber optic sensor principle is based on change in refractive index of the medium surrounding to its core [19]. These sensors are simple and accurate sensing technique over other sensing devices. Optical fibers sensor technology promises us sensing at lower concentration (ppm/ppb) in a real sophisticated manner [20–22]. Thus, it will be having promising future and give an unprecedented insight for low cost fiber optic sensors.

1.1. Evanescent Wave Fiber Optic Chemical Sensor (EWFOCS)

Now a day's fiber optic sensors (FOS) are playing a curtail role in sensor field. Various types of FOS are developed for detection of a variety of chemical species in water and different liquids. Among them evanescent wave absorption technique is found to be most useful technique

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ABSTRACT BOOK

Vellore Institute of Technology, Chennai - 600127, Tamilnadu

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January 8-11, 2020

In Collaboration with

Indian Laser Association

A real time monitoring system for the vertical and horizontal etching of Fiber Bragg Grating (FBG) in a hydrofluoric (HF) acid solution is designed. In our experiment we used 40% concentrated HF solution at room temperature, which is corrosive in nature and capable of dissolving many materials. Because of its reactive nature with glass, we used Teflon container to carry out HF solution. The results of vertical and horizontal etching process of FBG in HF acid solution can be understood by the variation of the wavelength shift of FBG with etching time. Result shows that Vertical Etching of clad region has more advantageous than the Horizontal Etching.

CP-11-06

Highly sensitive fiber grating chemical sensors for detection of contaminants in water

Mangesh S. Jadhav[1], Aravind Bennal[2], Balesh Mastiholi[1], Anandkumar Lalasangi[3], Vijay Kulkarni[4], Jitendra Kumar[5], Om Prakash[5], U S Raikar[2], [1]Department of Physics, J S S Arts, Science and Commerce College, Gokak (Karnataka) – 591307, INDIA. [2]Department of Physics, Karnataka University, Dharwad, (Karnataka) 580 003, INDIA. [3]Department of Physics, Smt. I. S. Yadawad Government First Grade College Ramdurg (Karnataka), 591123, INDIA. [4]Department of Physics, Angadi Institute of Technology & Management, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi(Karnataka) 590009, INDIA. [5]Fiber Grating Lab, Fiber Sensors and optical spectroscopy Section, RRCAT, Indore, M.P, INDIA. *E-mail: arvindbennal@gmail.com*

Chemical sensing using optical fibers is under extensive research all over the world and many optical chemical sensors are widely used in application such as industry, environmental monitoring, medicine, biomedicine and chemical analysis. Fabricated with phase mask technique and designed FBG sensors for detection and determination of various contaminants in water. We examined in one of the chosen samples that the fluoride content in the drinking water was exceeding a level (> 1.5 ppm) more than the normal range (0.7–1.5 ppm) with sensitivity 0.00448 nm/ppm. Similar to fluoride, detection of chloride ion in drinking water is also essential in order to minimize the potential health effects originating from the ingestion of these ions in drinking water. This method offers a practical way to study the surrounding refractive index by detecting the reflected wavelength and output power. The designed FBG showed sensing at lower concentration in ppm level with sensitivity of 8.712 nm/ppm. Besides fluoride and chloride, the designed sensor can be used to detect other chemicals directly by connecting the sensor to the pipes or other sources with continuous monitoring. The proposed chemical grating sensors are highly sensitive, having quick response and cost-effective working at low concentration level.

CP-11-07

D-Shaped photonic crystal Fiber Bio-sensor with V-Groove analyte chamber

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In this paper, we present the results on simultaneous and decoupled measurement of temperature and refractive index using combination of normal and etched fiber Bragg grating (FBG). Etched FBG acts as a refractive index sensor for ambient medium while unetched FBG works as temperature sensor. Both the FBG at same Bragg wavelength of 1534.292 nm were inscribed side by side on H_2 loaded SMF-28 fiber. One of the FBG was etched using HF solution while other remains unetched. This sensor combo was utilized for thermal and refractive index measurement of isopropanol for the temperature range of 22 to 30 °C. The response of this sensor is linear for temperature and refractive index (RI) measurement in the investigated range. The Bragg wavelength shift (BWS) for temperature measurement is 75 pm (red shift) and for RI is 186 pm (Blue shift). This sensor has potential in simultaneous measurements of temperature and refractive index as required in biological media.

CP-11-18

An Interrogator unit for FBG based single point temperature measurement

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Fiber Bragg Grating(FBG) interrogation technique is based on frequency (λ) to amplitude conversion, usually referred to as edge filtering, in which the FBGs spectrum variations are translated in to optical power variations. These Variations in pico-watts /°C are converted to electrical signal using indigenously developed highly sensitive InGaAs photodiode based detector unit. Photodiode detector has flat photo sensitivity from 1.0 - 1.8 µm, and overall sensitivity of developed detector unit is 10 mV/ pico-watts. Micro controller with 12-bit ADC is used to digitize the FBG data. Compact and low cost stand-alone interrogator is developed for FBG based temperature measurement. Unit is calibrated using controlled heat source and linearization of FBG data have done. The result is verified with standard OSA based interrogator at Fiber Sensors & Optical Spectroscopy Section, RRCAT. With the prototype Interrogator unit, measurement resolution of 1°C is achieved in 40°C - 200°C temperature range with the accuracy of ±1°C.

CP-11-19

Sensitivity enhancement in grating sensors using CuO nanoparticles for temperature measurement

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In the present report we demonstrate temperature sensing using fiber Bragg grating fixed on a Teflon substrate, which has a large thermal expansion coefficient. The behavior of the coated material is unique in its response to the thermal stability based on mode of coating. We have explored the thermal response of FBG sensor mounted on the temperature unit on and after coating. The designed sensor is compact, cost effective and measures temperatures in the range of 25 °C to 200 °C. It has showed a linear relationship between wavelength shift and temperature change along with 0.59 pm / °C enhancement in the sensitivity. However, by optimizing the materials and physical dimensions of FBG, it is possible to increase the range of temperature detection thereby improving the performance of sensor. It is observed that sensitivity of the nanoparticles- coated FBG is better than that of the bare FBG for all ranges of temperature.

CP-11-20

Development of FBG sensor for detection of thiocynate in water

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In this work, we report a systematic investigation of thiocynate in water using highly sensitive fiber grating sensor. Grating sensors are playing more and more vital roles in the detection of contaminants, adulterant and environmental pollutants for their high efficiency, high accuracy and low cost. The fabricated photosensitive fiber designed to make more sensitive followed by etching process. Etched portion acts as sensing reason of the sensors to react with surrounding media. Designed sensor is more sensitive in detection of thiocynate present in water and sensitiveness is of 1.71 nm/ppm for lower concentration range. The FBG based methodology has the potential for its simple design and easy to operate to be used in a sensing approach for SCN in water.

CP-11-21

Fiber optics evanescent wave sensor for detection of Zinc in water

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Fiber Optics evanescent wave chemical sensors have created interest in the determination of various elements in the water, which are creating toxicity and may cause serious health problems. In this paper, we demonstrated a sensor for detecting Zinc in the water. The experimental results show that 0.003694 mW change in power per ppm. The results also highlight the high sensitivity and the simplicity of the design, low cost of fabrication, compact size, and easy integration with optoelectronic devices, make it suitable for chemical, medical and biological applications.

CP-11-22

3dB flattened gain of EDFA by introducing long period fiber grating

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In today's era of wavelength division multiplexing optical networking systems, erbium doped fiber amplifier having flat gain is play a vital role to reimburse large variation in the power difference between channels at the output side. A flat gain of EDFA is achieved by changing a material composition, by using gain flattening filter and hybrid amplifier. This paper highlights on non-uniform gain spectrum of EDFA which is flatten by introducing long period fiber gratings with attenuation peaks tuned to compensate for peak gain of EDFA. Results shows that EDFA gain peak of 35.94 db is achieved at 1532.89 nm wavelength which is flatten up to 2.44 dB by using long period fiber gratings with grating period 240 μm and 30 mm length. It can also be observed that approximately ± 0.5 dB gain flatness is achieved.