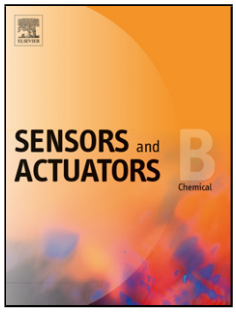

Title: Marine Salinity Sensing Using Long-period Fiber Gratings Enabled by Stimuli-responsive Polyelectrolyte Multilayers

Authors: Fan Yang, Svetlana Sukhishvili, Henry Du, Fei Tian

PII: S0925-4005(17)31140-1
DOI: http://dx.doi.org/doi:10.1016/j.snb.2017.06.121
Reference: SNB 22592

To appear in: *Sensors and Actuators B*

Received date: 19-1-2017
Revised date: 15-6-2017
Accepted date: 17-6-2017

Please cite this article as: Fan Yang, Svetlana Sukhishvili, Henry Du, Fei Tian, Marine Salinity Sensing Using Long-period Fiber Gratings Enabled by Stimuli-responsive Polyelectrolyte Multilayers, Sensors and Actuators B: Chemicalhttp://dx.doi.org/10.1016/j.snb.2017.06.121

Marine Salinity Sensing Using Long-Period Fiber Gratings Enabled by Stimuli-Responsive Polyelectrolyte Multilayers

Fan Yang, [1] Svetlana Sukhishvili, [2] Henry Du, [1] Fei Tian, [1,*]

[1]Department of Chemical Engineering and Materials Science, Stevens Institute of Technology, Hoboken, NJ 07030

[2]Department of Materials Science and Engineering, Texas A&M University, College Station, Texas 77843

[*]Corresponding author: ftian1@stevens.edu

Abstract

A highly sensitive fiber-optic salinity sensor synergistically combining long-period gratings (LPG) and stimuli-responsive polyelectrolyte multilayers is demonstrated. The LPG coupled with $LP_{0,10}$ cladding mode was coated with ionic-strength-responsive chitosan (CHI)/poly (acrylic acid) (PAA) polyelectrolyte multilayers *via* the layer-by-layer (LbL) assembly technique. This LbL-coated LPG was exposed to NaCl solutions with varying concentrations for salinity measurement. The LPG resonance wavelength underwent a change from red shift to blue shift at the salt concentration of 0.5 M over the 0.1-0.8 M range at pH 7.5. A significant blue shift with a sensing response of 36 nm/M was observed from 0.5 to 0.8 M, relevant to that of seawater. This sensitivity is one order of magnitude higher than that obtained using as fabricated LPG without the stimuli-responsive LbL multilayers as well as documented studies. The mechanism associated with the salinity response of the LbL multilayers is discussed.

Keywords: Fiber-optic sensors; ; ; ; , Salinity, Long period gratings, Polyelectrolytes, Layer-by-layer assembly

1. Introduction

Real-time monitoring of salt concentration in aqueous solution is in increasing demand for a variety of sectors ranging from life sciences, agriculture to climate and marine studies. For example, maintaining specific salt concentrations is important for vital functions of many animals and plants, and is critical for shellfish productivity and algal blooms [1]. Salinity measurements are also crucial in climate change research, as they provide essential information on factors influencing global weather such as ocean