

Title: Silicate-glass based photonic crystal fiber for rapid petro-chemical sensing: Design and analysis

Author Names: Md Rezaul Hoque Khan a , Md Sanowar Hosen a b , Atiqul Alam Chowdhury a , Mohammad Rakibul Islam a, Fahim Faisal a , Mirza Muntasir Nishat a, Nafiz Imtiaz Bin Hamid

Abstract: The distillation method for extracting anhydrous ethanol from the volatile benzene water requires continuous supervision in the petro-chemical industry. This paper describes the design process and numerical analyses of a [PCF](#) sensor with a hollow core for sensing the petro-chemical constituents, namely ethanol, water, and benzene, in the 2 [THz](#) range. Photonic crystal fiber sensors have many possible applications in the petro-chemical industry, environmental monitoring, biomedicine, and food preservation. An optical fiber-based sensor with simultaneous low loss and enhanced sensitivity is intended to detect this petro-chemical effectively and safely. The [Finite Element Method](#) (FEM) framework is used to quantify the exhibition of the suggested fiber sensor. The simulation outcomes on the suggested sensor model demonstrate very satisfactory results on the relative sensitivity as 99.55 , 99.44 and 99.59 confinement loss as dB/cm, dB/cm and dB/cm, Effective Material Loss (EML) as 0.00043 cm, 0.00054 cm and 0.00038 cm for Ethanol, Water and Benzene, respectively and the Effective areas (EAs) are for Ethanol, for Water and for Benzene at 2 THz frequency regime.

Keywords: Optical sensor Photonic crystal fiber Relative sensitivity Effective material loss Analyte

<https://www.sciencedirect.com/science/article/pii/S2214180423000314>

<https://doi.org/10.1016/j.sbsr.2023.100579>