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THEORETICAL ANALYSIS OF NONLINEAR OPTICAL WAVEGUIDE SENSORS: TE CASE

RAHROVAN ZAHRA[1] & SHAHMIRZAEE HOSSEIN[2]

[1]Department of Physics, Science and Research Branch, Islamic Azad University, Fars, Iran

[2]Air Ocean Research Center, Shiraz, Iran

ABSTRACT

In the present paper, an analytical theory will be investigated for studying three-layer slab waveguide for sensor applications. The sensor is a proposed nonlinear optical waveguide including a linear thin film with thickness $\boldsymbol{h}$ and dielectric constant $\boldsymbol{\varepsilon_f}$ that is surrounded by a substrate with nonlinear permittivity $\boldsymbol{\varepsilon_1}$and a cover with nonlinear permittivity $\boldsymbol{\varepsilon_2}$. Nonlinear environments are of Kerr type. One of the best quantities studied in the research is sensor sensitivity, that is determined with change in effective refractive index $\boldsymbol{N}$ for changing in refractive index of cover medium $\boldsymbol{n_c}$. Status of obtaining max sensitivity for nonlinear waveguide sensors $\boldsymbol{TE}$ has been investigated and compared with linear sensors. Guide layer has been chosen as $\boldsymbol{Si_3N_4}$and $\boldsymbol{GaN}$ and we have applied silica as cover and substrate environment with some percent impurity. Our proposed sensor with sensitivity of $\boldsymbol{S_h}$= 0. 2798 increases up to 105.433% and thickness of sensor has decrease of h=105 nm up to 41.666% compared to previous proposed sensors of researchers**.**

KEYWORDS: Waveguide Sensor, Sensitivity, Refractive Index, Cover, Substrate