Fuel Phononic Crystal Sensor for the Determination and Discrimination of Gasoline Components

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Research Article

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Abstract

In this work, we have introduced theoretically a novel design of a 1D phononic crystal model acting as a sensor for gasoline components (blends). The proposed sensor is prepared to distinguish between different components of gasoline with high performance. The sensor is designed from a defect layer filled with one of the gasoline blends in the middle of a 1D multilayer phononic crystal configured as, [(lead/ epoxy)^2 gasoline [(lead / epoxy)^2] . The numerical investigations are obtained based on the transfer matrix method and the acoustic properties of the constituent materials. The numerical results showed that our sensing tool can distinguish between different gasoline blends with high selectivity and sensitivity at the same time. In addition, the monitoring of these blends could be obtained. The proposed sensor provides high sensitivity and quality factor that can reach 2.97×10^7 Hz and 5034, respectively.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures

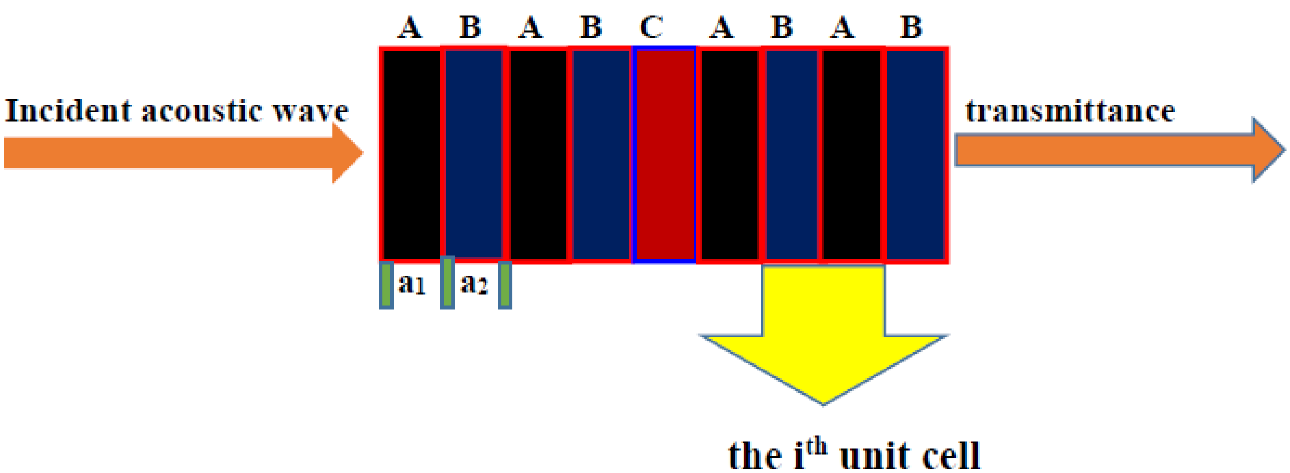

Figure 1

A schematic diagram of the proposed gasoline sensor based 1D defective PnCs that configured as [(lead / epoxy) 2 [gasoline blends] (lead / epoxy) 2].

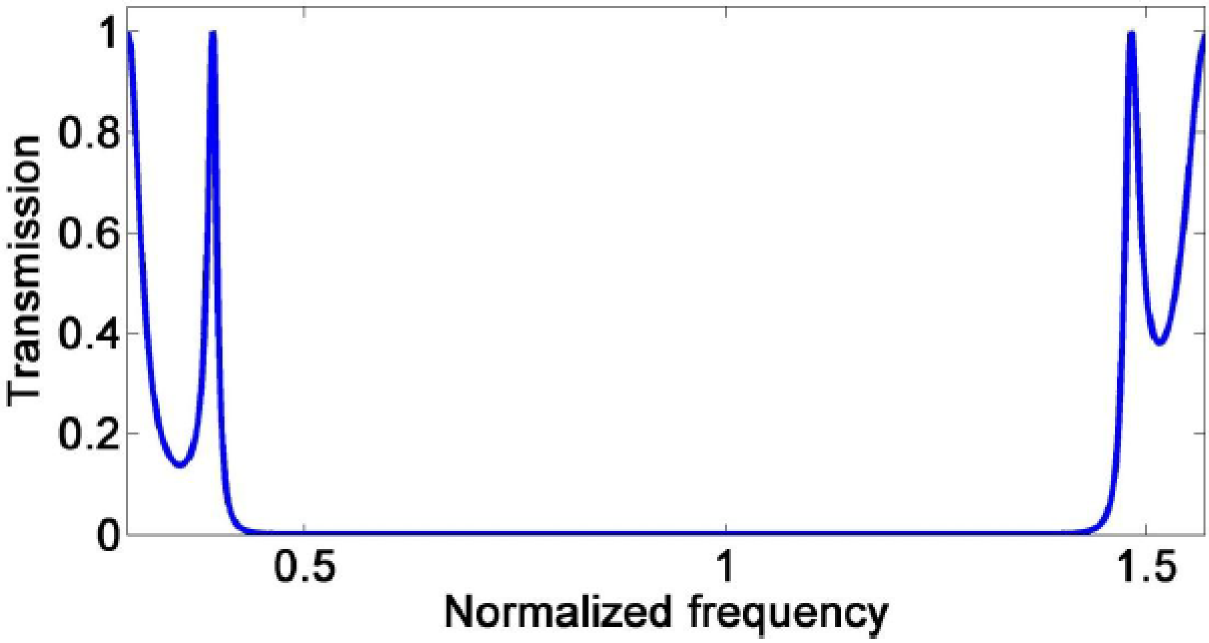

Figure 2

The transmission spectrum of perfect 1D PnC structure that configured as (lead/epoxy) 4.

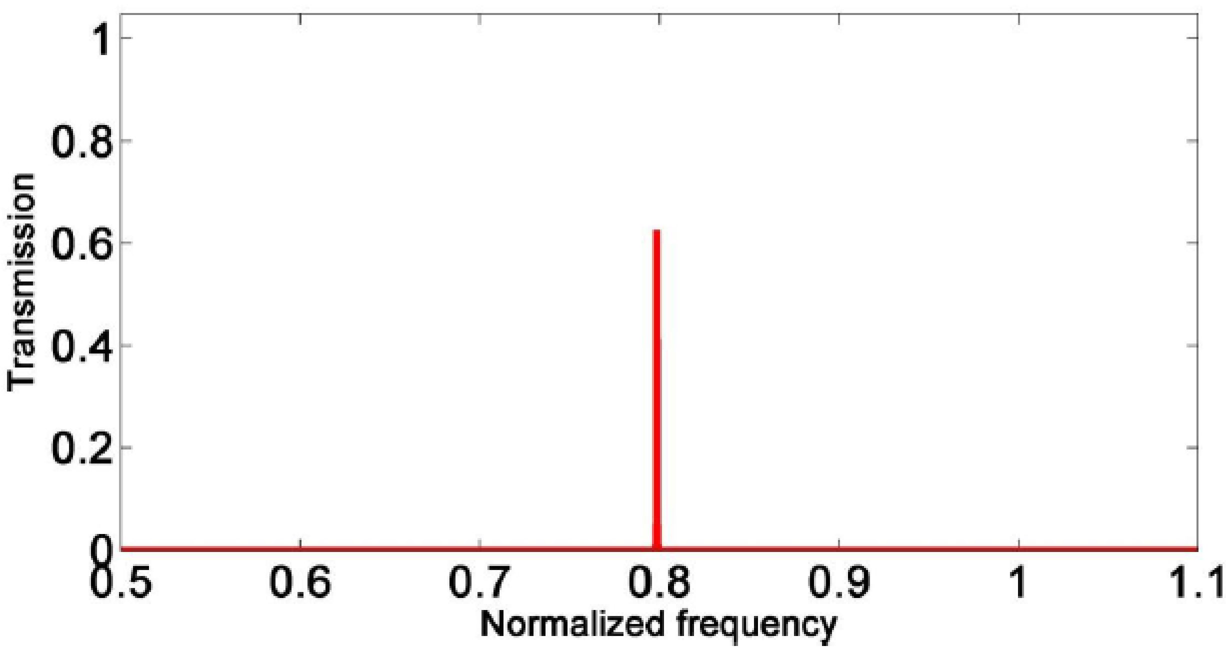

Figure 3

The transmission spectrum of the 1D defective PnC structure that configured as, [(lead / epoxy) 2 [defect layer] (lead / epoxy) 2] at room temperature.

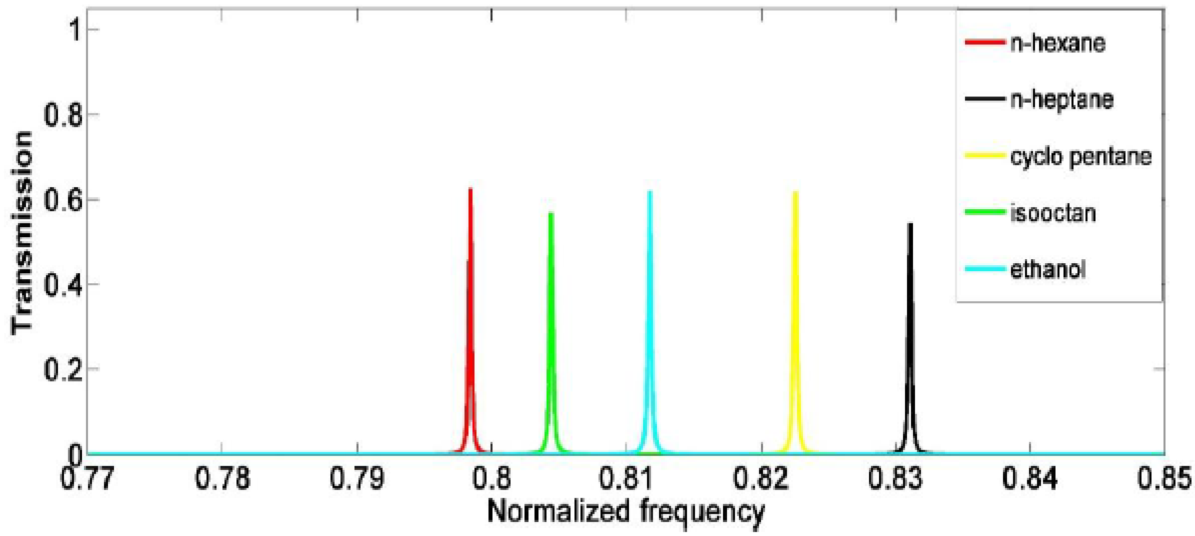

Figure 4

The dependence of transmission characteristics of the resonant mode on the type of gasoline components.

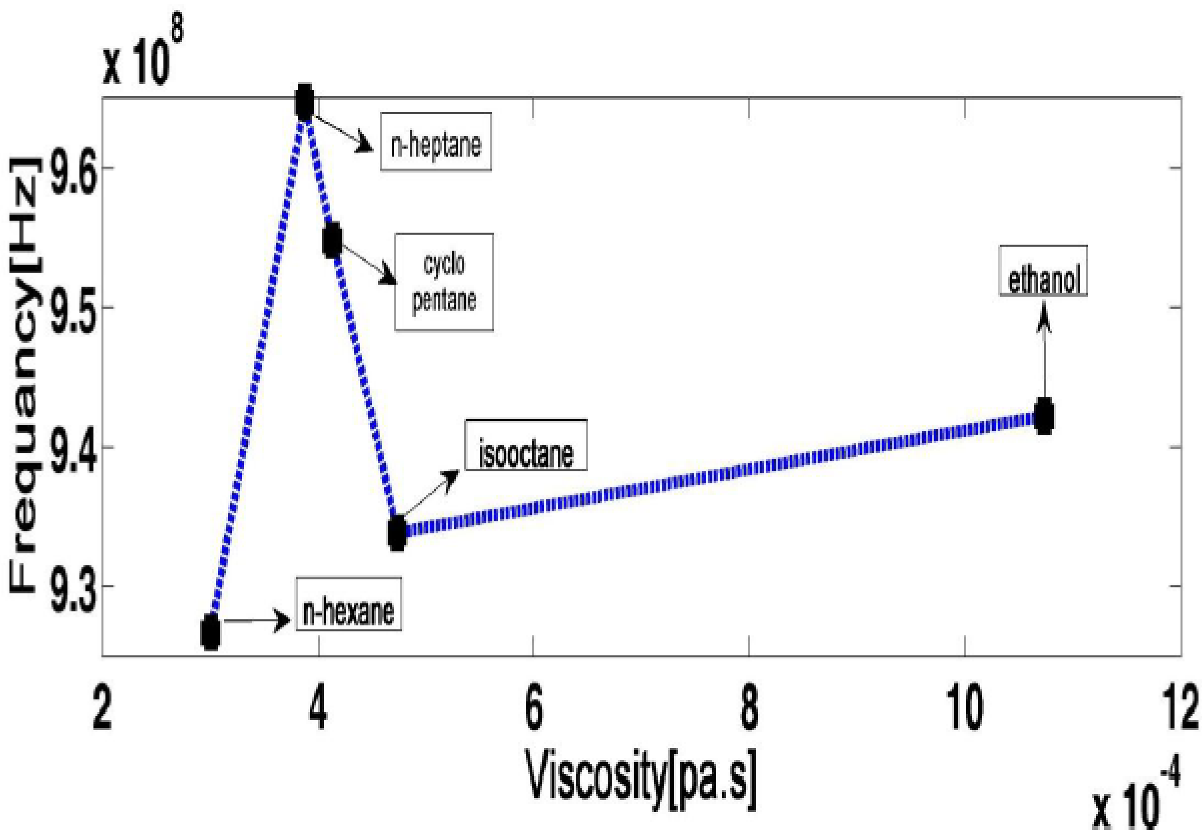

Figure 5

The relation between the resonant frequency of each gasoline blend with its viscosity value.

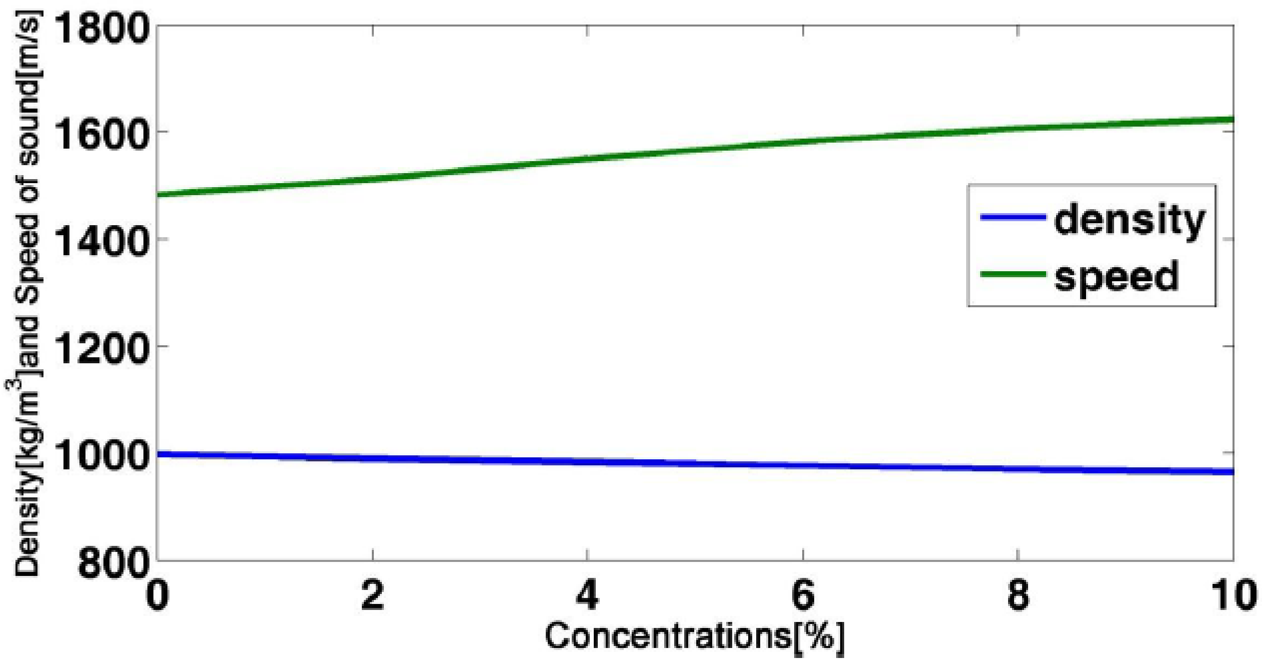

Figure 6

The dependence of the acoustic properties of ethanol on its concentration.

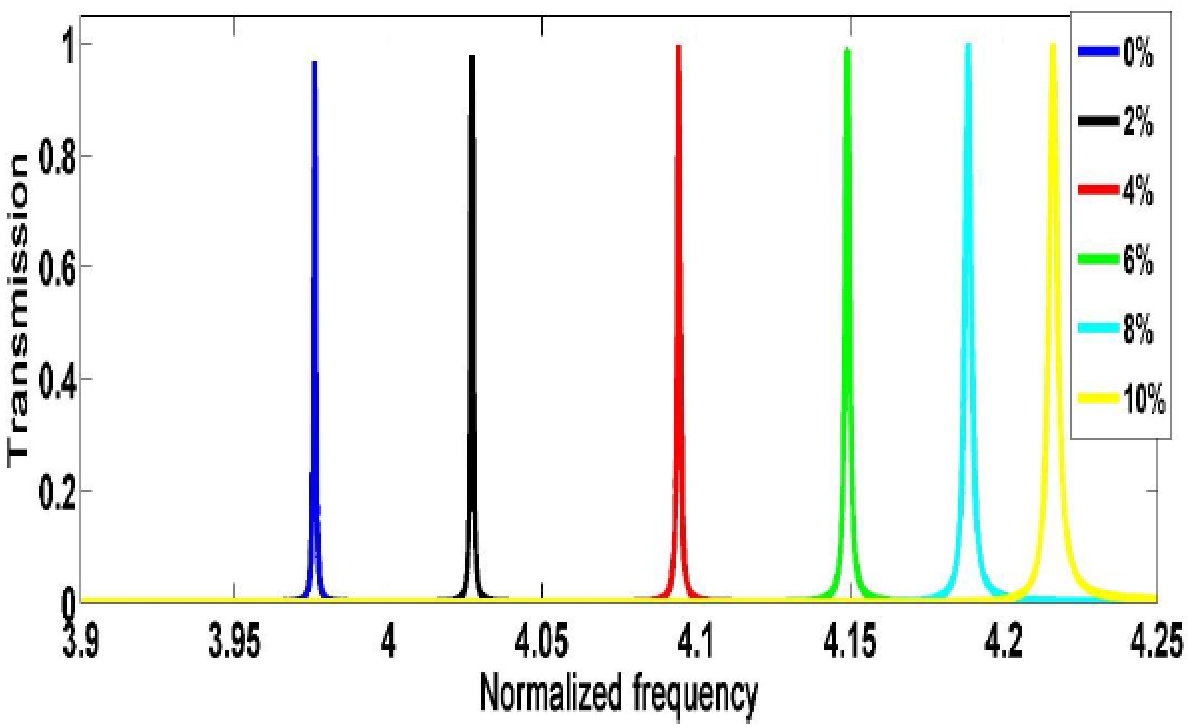

Figure 7

The effect of ethanol concentration on the position of the resonant peak.

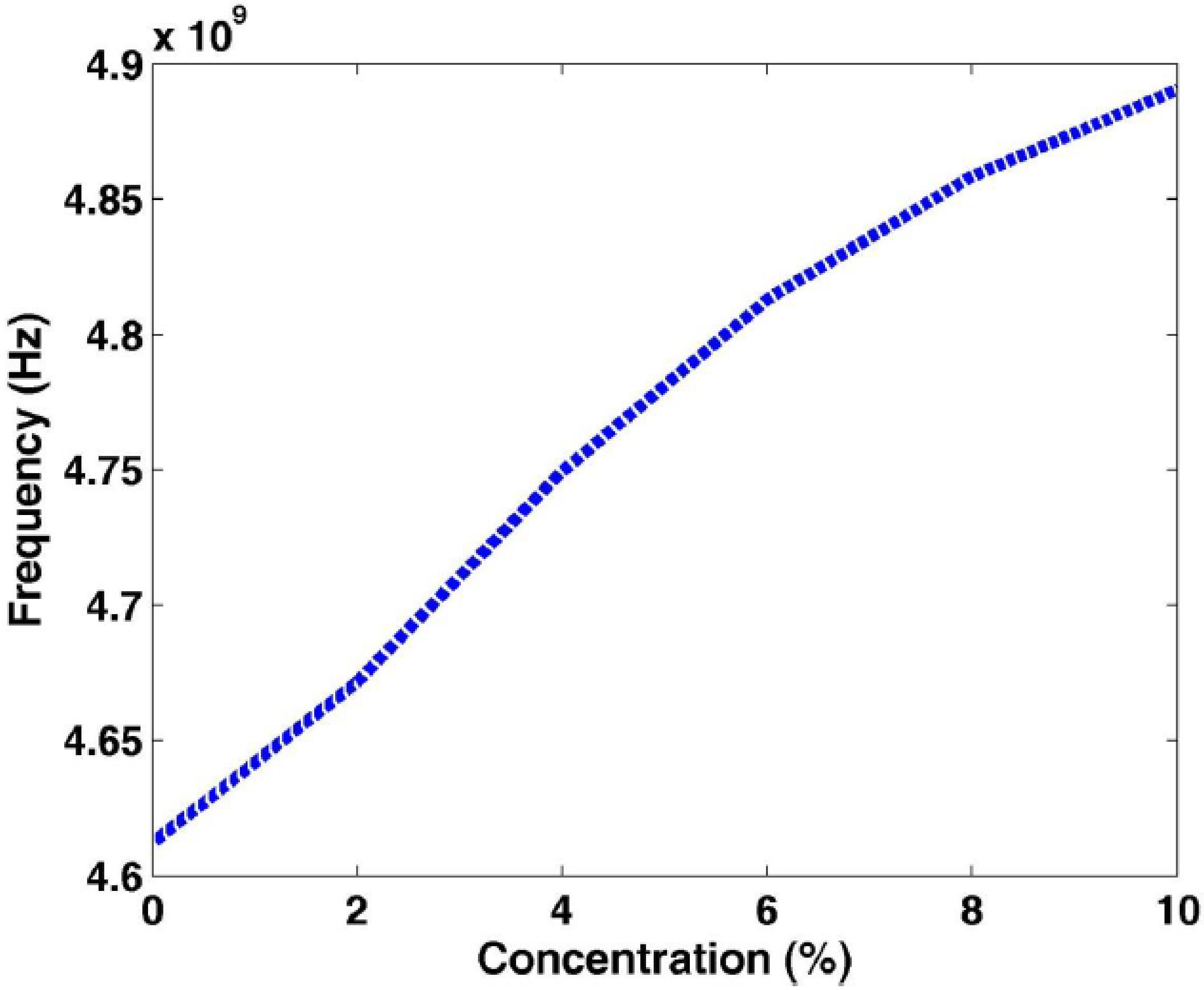

Figure 8

The response of the resonant peak position with the change of ethanol concentration.