H-shaped fishnet metamaterial sensor for sub-terahertz region

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Terahertz region provides us lots of advantages and the number of devices that are using THz waves is increasing day by day. Metamaterials are artificial materials which can help us to do unachievable goals by their exotic electromagnetic properties. Metamaterials are started to be used widely in different devices like lenses, antennas, modulators and sensors and THz region is one of the most contributed region of electromagnetic spectrum by metamaterials. In this study we design a fishnet metamaterial sensor that can detect materials from their electromagnetic properties and also can detect the thickness of that material by using THz waves. The proposed design is unique and both side of the sensor can be used for sensing which increases the efficiency and for some cases applicability of the sensor. Firstly frequency resonances were found and from the surface current and electric field distributions the theory behind the frequency resonances has been described. The material that is going to be detected was added to the structure as single and double overlayer and the frequency shifts at the resonance have been observed against different dielectric constant and thickness values. The material that is going to be detected can be detected from that frequency shift values. The sensitivity of the proposed sensor was calculated and compared with the existing ones and the applicability of the sensor is proved.
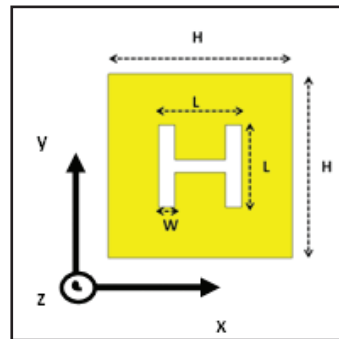

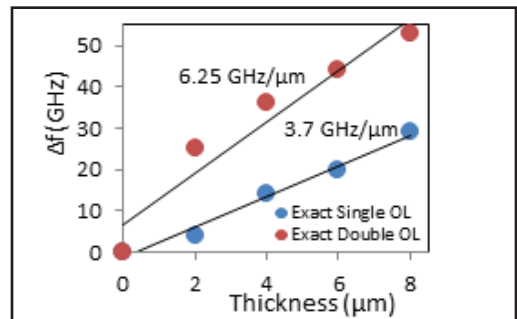*Figure 1. Front view and side view of proposed structure*

Figure 2. Frequency shift of Fishnet MTM versus Double and Single overlayer thickness with the fitted curves

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