

Title: Modelling and analysis of a triple-band metamaterial absorber for early-stage cervical cancer HeLa cell detection

Author: S.M. Anowarul Haque, Meraj Ahmed, Abdulrahman Alqahtani, Mahamudur Rahman, Mohammad Tariqul Islam, Md. Samsuzzaman

Abstract: The paper introduces a unique design and analysis of a terahertz metamaterial absorber (MMA) that can be used for early detection of cervical cancer by employing microwave imaging techniques. Computer Simulation Technology (CST) is used to design and analyze the proposed absorber. The MMA operates in the frequency range of 6–8 THz and can absorb energy in three specific spectral bands: 6.606 THz, 6.824 THz, and 7.426 THz, with absorption peaks of 99.75 %, 99.87 %, and 99.73 % correspondingly. The working principle of the absorber is described using the impedance matching and interference theory. The electric field (E), magnetic field (H), and surface current of the MMA are also examined. Finally, detecting cancerous HeLa cells is also being investigated by analyzing the E-field and H-field using microwave imaging. The suggested biosensor features a high-quality factor of 494.3, a frequency shifts per refractive index of 1.08 THz/RIU, and a figure of merit (FOM) of 42. The suggested MMA-based sensor has numerous advantages and can be utilized for early-stage cervical cancer detection.

Keywords: Terahertz metamaterial absorber (MMA), Microwave imaging, Cervical cancer detection, HeLa cells, Biosensor, Impedance matching, Interference theory

DOI: <https://doi.org/10.1016/j.optlaseng.2024.108426>

<https://www.sciencedirect.com/science/article/abs/pii/S0143816624004044>