

**THE 6<sup>TH</sup> ACADEMIC CONFERENCE  
ON NATURAL SCIENCE  
FOR YOUNG SCIENTISTS,  
MASTER AND PHD STUDENTS  
FROM ASEAN COUNTRIES**

**23rd – 26th October 2019**

**THAI NGUYEN, VIETNAM**

**[https://iop.vast.ac.vn/activities/conf\\_asean/2019/](https://iop.vast.ac.vn/activities/conf_asean/2019/)**

**CASEAN - 2019**

- P34 INFLUENCE OF MESOSCOPIC TiO<sub>2</sub> ELECTRON TRANSPORT LAYER THICKNESS ON THE PERFORMANCE OF MIXED ORGANIC - INORGANIC HALIDE PEROVSKITE SOLAR CELLS**  
*Thach Thi Dao Lien, Pham Van Phuc, Vu Duy Phuong, Nguyen Thi Tu Oanh, Pham Duy Long, Pham Van Hoi, Le Ha Chi*  
*Graduate University of Science and Technology*
- P35 SCANNING KNIFE-EDGE METHOD FOR UV LASER SIZE MEASUREMENTS ORIENTATION IN LIDAR TECHNIQUE**  
*Nguyen Xuan Tu*  
*Institute of Physics, VAST*
- P36 EFFECT OF HALIDE ANIONS ON STRUCTURE OF LANGMUIR MONOLAYER-WATER INTERFACE PROBED BY SUM-FREQUENCY VIBRATIONAL SPECTROSCOPY USING A PICO-SECOND LASER**  
*Nguyen Thi Hue, Nguyen Thi Hong Thoa*  
*Hung Vuong University*
- P37 THERMAL TUNABLE PERFECT ABSORPTION BEHAVIOR IN METAMATERIAL ON SUPER-HIGH DIELECTRIC CONSTANT MATERIAL**  
*Dinh Van Thien, Tran Tien Lam, Le Duc Tuyen, Bui Xuan Khuyen, Vu Dinh Lam*  
*Department of Physics, Hanoi University of Mining and Geology*
- P38 INFLUENCE OF THE PARAMETERS ON THE SQUARE-TRIANGULAR STRUCTURE OF METAMATERIALS IN THE FREQUENCY RANGE FROM 0-18 GHz**  
*Vu Duy Phuong, Tran Tien Lam, Dinh Van Thien, Tran Quoc Ve, Tran Manh Cuong, Vu Dinh Lam*  
*Faculty of Physics, Hanoi National University of Education*
- P39 INFLUENCE OF THE INTEGRATED ELEMENTS ON PERFECT ABSORPTION IN ULTRATHIN METAMATERIAL PERFECT ABSORBER**  
*Tran Tien Lam, Dinh Ngoc Dung, Dinh Van Thien, Pham The Linh, Le Duc Tuyen, Bui Xuan Khuyen, Bui Son Tung and Vu Dinh Lam*  
*Faculty of Physics, Thai Nguyen University of Education*

## THERMAL TUNABLE PERFECT ABSORPTION BEHAVIOR IN METAMATERIAL ON SUPER-HIGH DIELECTRIC CONSTANT MATERIAL

***Dinh Van Thien*<sup>1,2\*</sup>, Tran Tien Lam<sup>1,3</sup>, *Le Duc Tuyen*<sup>1,2</sup>,  
Bui Xuan Khuyen<sup>1</sup>, Vu Dinh Lam<sup>1</sup>**

1. *Department of Physics, Hanoi University of Mining and Geology, 18 Vien Street, Bac Tu Liem, Hanoi*
2. *Institute of Materials Science, VAST, 18 Hoang Quoc Viet Street, Cau Giay, Hanoi*
3. *Faculty of Physics, Thai Nguyen University of Education, 20 Luong Ngoc Quyen street, Thai Nguyen city, Thai Nguyen Province*

*E-mail: thiendv89@gmail.com*

More recently, the exotic advantages on subwavelength unit cells are also applied to pave the way for developing optoelectronic applications [1-3]. In this work, we investigated a metamaterial perfect absorber (MPA) designed by using the CST Microwave Studio software in the THz range. The proposed MPA structure, which is integrated with a super-high dielectric constant material (strontium titanate – STO), contains four lumped inductors (with  $L = 1\text{nH}$ ) to thermally control absorption behavior. The STO undoped-MPA can maintain an absorption rate over 90% at 2.0 GHz in a wide incident angle of electromagnetic wave. By doping STO in the dielectric layer of initial design, absorption peak is raised and effectively tuned in the THz region. Since the temperature of STO is changed from 300 to 450 K, the absorption peak is blue-shifted (from 0.1 to 0.3 THz). Furthermore, the main absorption mechanism is also clearly clarified through the combination between the strong magnetic resonance and the impedance matching phenomena. Our results are useful for future applications at THz frequencies and promising for fabricating high-frequency MPAs based on cost- and performance-effective, large-size meta-surface.

**Keywords:** Strontium titanate, Metamaterials, Perfect absorption, Tunable

### REFERENCES

1. Bui Xuan Khuyen, Bui Son Tung, Young Ju Kim, Ji Sub Hwang, Ki Won Kim, JooYull Rhee, Vu Dinh Lam, Yong Hwan Kim, YoungPak Lee, *Ultra-subwavelength thickness for dual/triple-band metamaterial absorber at very low frequency*, Scientific Reports, (2018) 8:11632. DOI:10.1038/s41598-018-29896-4
2. B.X. Khuyen, B.S. Tung, Y.J. Yoo, Y.J. Kim, V.D. Lam, J.G. Yang, Y.P. Lee, *Ultrathin metamaterial-based perfect absorbers for VHF and THz bands*, Current Applied Physics, (2016), doi: 10.1016/j.cap.2016.05.027.
3. Cheng Gong, Mingzhou Zhan, JingYang, Zhigang Wang, Haitao Liu, Yuejin Zhao, Weiwei Liu, *Broadband terahertz metamaterial absorber based on sectional asymmetric structures*, Scientific Reports, 6:32466 | DOI: 10.1038/srep32466.