



Results from research project

Contract No: DFNI-T-02/26
Initial and final date of the project: 12.12.2014- 15.05.2018
Project title: New hybrid structures, based on photorefractive crystals-liquid crystals and graphene
Research organization: Institute of Optical Materials and Technologies (IOMT)
Partner organizations: Institute of Solid State Physics (ISSP) University of Chemical Technology and Metallurgy
Principle investigator: Vera Marinova, Assoc. Prof.

Publication from the project
For each publication, please, provide: – Bibliographic information (<i>for journals with IF, please, provide the IF of the journal in the year of publication</i>) – Internet link to the publication in the electronic version of the journal and/or link to publically accessible electronic version of the publication
A. Encyclopedia and book chapters 1. Vera Marinova, Shiuan Huei Lin and Hsu Yuh Ken, "Two-wave mixing in organic-inorganic hybrid structures for dynamic holography" book chapter in Holographic Materials and Optical Systems, Intech ISBN 978-953-51-5033-6, (2017) 2. Vera Marinova, Shiuan Huei Lin and Hsu Yuh Ken "Photorefractive Effect: Principle, Materials and Near-Infrared Holography" chapter in Wiley Encyclopedia of Electrical and Electronics Engineering, invited, EEEE-15-0078, (2016)
B. Journal papers with IF and Impact Rank 1. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu "Organic-inorganic hybrid structure for high-resolution spatial light modulator" Proc. SPIE v. 10557, 105570D (2018) http://spie.org/Publications/Proceedings/Paper/10.1117/12.2300152 2. Zhelev V, P. Petkov, P. Shindov, I. Bineva, S. Vasilev, V. Ilcheva, T. Petkova "As-doped SnO₂ thin films for use as large area position sensitive" Thin Solid Films 653, 19-23 (2018) IF=1.939 https://www.sciencedirect.com/science/article/pii/S0040609018301469 3. Victor G. Ivanov, Nataliya Kalashnyk, Jeremy Sloan, and Eric Faulques "Vibrational Dynamics of Extreme 2 × 2 and 3 × 3 Potassium Iodide Nanowires Encapsulated in Single-Walled Carbon Nanotubes" 98, 125429 Phys Rev B (2018) IF= 3.836



<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.98.125429>

4. Z. Wang, N. Qureshi, S. Yasin, A. Mukhin, E. Ressouche, S. Zherlitsyn, Y. Skourski, J. Geshev, V. Ivanov, M. Gospodinov and V. Skumryev "Magnetoelectric effect and phase transitions in CuO in external magnetic fields" **Nature Communications** 7, 10295 (2017) IF = 12.353
<https://www.nature.com/articles/ncomms10295>
5. K. Shrestha, D. Graf, V. Marinova, B. Lorenz, and C. W. Chu "Weak anti-localization effect due to topological surface states in Bi₂Se_{2.1}Te_{0.9}" **Journal of Applied Physics** 122, 145901 (2017) IF=2.176 <https://aip.scitation.org/doi/10.1063/1.4997947>
6. K. Shrestha V. Marinova, D. Graf, B. Lorenz, and C. W. Chu "Large magnetoresistance and Fermi surface study of Sb₂Se₂Te single crystal" **Journal of Applied Physics** 122, 125901 (2017) IF=2.176
<https://aip.scitation.org/doi/abs/10.1063/1.4998575?ai=1gvoi&mi=3ricys&af=R>
7. K. Shrestha, V. Marinova, D. Graf, B. Lorenz, and C. W. Chu "Simultaneous detection of quantum oscillations from bulk and topological surface states in metallic Bi₂Se_{2.1}Te_{0.9}" **Philosophical Magazine**, 97, (20), 1740–1754 (2017) IF =1.632
<https://www.tandfonline.com/doi/abs/10.1080/14786435.2017.1314563?journalCode=tpbm20>
8. K. Shrestha, V. Marinova, D. Graf, B. Lorenz, and C. W. Chu "Quantum oscillations in metallic Sb₂Te₂Se topological insulators" **Phys. Rev. B** 95, 075102 (2017) IF= 3.83
<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.95.075102>
9. V Marinova, Z F Tong, S Petrov, S H Lin, M S Chen, Y H Lin, Y C Lai, P Yu and K Y Hsu "Liquid crystal cell with graphene electrodes" **J Phys Conf. Series** 794, 012009 (2017)
<https://iopscience.iop.org/issue/1742-6596/794/1>
10. D Dimitrov, P Rafailov, V Marinova, T Babeva, E Goovaerts, Y F Chen, C S Lee, and J Y Juang "Structural and optical properties of LuVO₄ single crystals" **J Phys Conf. Series** 794, 012029 (2017) <https://iopscience.iop.org/issue/1742-6596/794/1>
11. N. Berberova, D. Daskalova, V. Strijkova, D. Kostadinova, D. Nazarova, L. Nedelchev, E. Stoykova, V. Marinova, C. H. Chi, S. H. Lin "Polarization holographic recording in thin films of pure azopolymer and azopolymer based hybrid materials" **Opt. Mat.** 64, 212-216 (2017) IF= 2.566 <https://www.sciencedirect.com/science/article/pii/S0925346716307170>
12. Stefan Petrov, Vera Marinova, Shiuan Huei Lin, Chia Ming Chang, Yi Hsin Lin, and Ken Y. Hsu "Large Scale Liquid Crystal Device with Graphene-based Electrodes" **Opt. Data Process. Storage** 3:114–118 (2017) Open Access
<https://www.degruyter.com/view/j/odps.2017.3.issue-1/odps-2017-0015/odps-2017-0015.xml>
13. Vera Marinova, Ren-Chung Liu, Shiuan Huei Lin, Ming-Syuan Chen, Yi-Hsin Lin and Ken-Yuh Hsu "Near infrared sensitive organic–inorganic photorefractive device" **Optical Review** 23 (5,) 811–816 (2016) IF=0.72 <https://link.springer.com/article/10.1007/s10043-016-0244-4>
14. V. Marinova, C. H. Chi, Z. F. Tong, N. Berberova, R. C. Liu, S. H. Lin, Y. H. Lin, E. Stoykova and K. Y. Hsu "Liquid crystal light valve operating at near infrared spectral range" **Optical and Quantum Electronics**, 48, 270 (2016)
IF=1.168 <https://link.springer.com/article/10.1007/s11082-016-0546-6>
15. R. Georgiev, L. Todorova, D. Christova, B. Georgieva, M. Vasileva and T. Babeva "Influence of PEO, PDMAA and corresponding di- and triblock copolymers on the optical properties of



- niobia thin films" **Bulg. Chem. Commun.**, Volume 48, Special Issue G pp. 167-172 (2016) **IF=0.349**
http://www.bcc.bas.bg/bcc_volumes/Volume_48_Special_A_2016/BCC-48-Special-A.pdf
16. N. Bozhinov, B. Blagoev, V. Marinova, T. Babeva, E. Goovaerts, D. Dimitrov "Properties of ALD Aluminum-doped ZnO as transparent conductive oxide" **Bulg. Chem. Commun.**, Volume 48, pp. 193-197 (2016) **IF=0.349** <http://www.bcc.bas.bg/>
17. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu "Electro-optically and all optically addressed spatial light modulator devices based on organic-inorganic hybrid structures" **SPIE** Vol. 10022 p.100220V-1 (2016) <https://www.spiedigitallibrary.org/conference-proceedings-of-spie/10022.toc>
18. Vera Marinova, Zhong Fang Tong, Stefan Petrov, Daniela Karashanova, Yi Hsin Lin, Shiuan Huei Lin and Ken Yuh Hsu "Graphene oxide doped PDLC films for all optically controlled light valve structures" **SPIE**, 9970 (2016) <https://www.spiedigitallibrary.org/conference-proceedings-of-spie/9970/997009/Graphene-oxide-doped-PDLC-films-for-all-optically-controlled-light/10.1117/12.2238508.short>
19. N. Berberova, D. Nazarova, L. Nedelchev, B. Blagoeva, D. Kostadinova, V. Marinova and E. Stoykova "Photoinduced variation of the Stokes parameters of light passing through thin films of azopolymer-based hybrid organic/inorganic materials" **J Phys Conf. Series** 700 (1) 012032 (2016) <https://iopscience.iop.org/article/10.1088/1742-6596/700/1/012032/pdf>
20. Y-C Lai, P M Rafailov, E Vlaikova, V Marinova, S H Lin, P Yu, G C Chi, D Dimitrov, P Sveshtarov V Mehadjiev and M M Gospodinov Chemical vapour deposition growth and Raman characterization of graphene layers and carbon nanotubes" **J Phys Conf. Series** 682, 012009 (2016) <https://iopscience.iop.org/article/10.1088/1742-6596/794/1/012009/pdf>
21. K. Lazarova, R. Georgiev, M. Vasileva, B. Georgieva, M. Spassova and T. Babeva, "One-dimensional hybrid photonic crystals for sensing applications", **Optical and Quantum Electronics**, Springer, Volume: 48 Issue: 6 Article Number: 310 (2016) **IF=1.168** <https://link.springer.com/article/10.1007/s11082-016-0577-z>
22. Lian Nedelchev, Dimana Nazarova, Nataliya Berberova, Georgi Mateev, Veronica Salguirino, David Schmool, "Enhanced photoanisotropic response in azopolymer doped with elongated goethite nanoparticles" **Journal of Physics: Conference Series** 700, 012031 (2016) <https://iopscience.iop.org/article/10.1088/1742-6596/700/1/012031/meta>
23. V G Ivanov, N D Todorov, L S Petrov, T Ritacco2, M Giocondo, E S Vlahov "Strong surface enhanced Raman scattering from gold nanoarrays obtained by direct laser writing" **Journal of Physics: Conference Series** 764 (2016) 012023 <https://iopscience.iop.org/article/10.1088/1742-6596/764/1/012023/meta>
24. Victor G. Ivanov, Emil S. Vlahov, George E. Stan, Marian Zamfirescu, Catalina Albu, Natalia Mihailescu, Irina Negut, Catalin Luculescu, Marcela Socol, Carmen Ristoscu, and Ion N. Mihailescu "Surface-enhanced Raman scattering activity of niobium surface after irradiation with femtosecond laser pulses" **J of Applied Physics** 118, 203104 (2015) **IF=2.176** <https://aip.scitation.org/doi/10.1063/1.4936363>
25. Vera Marinova, Ren Chung Liu, Shiuan Huei Lin, Yi Hsin Lin and Ken Yuh Hsu "Rh-doped Bi₁₂TiO₂₀ photorefractive crystals and their applications in near infrared sensitive light valve devices" **Asian Journal of Physics**, v. 24, n.2 (2015) <http://demo050307.hostgator.co.in/content2/vol-24-2015/vol-24-no-2>



26. V. Jelev, P. Petkov, Iv. Markova, T. Petrov "Thin films of metal oxides for preparing of a position sensitive photodetector" **Bulg. Chem. Commun.**, v. 47, pp. 173–176 (2015)
<http://www.bcc.bas.bg/>
27. P. Shindov, V. Zhelev, P. Petkov "Thin metal-oxide films deposited by spray-pyrolysis technique" **ANSTA** v. 4, 75 (2015)
28. V. Marinova, R. C. Liu, M. S. Chen, Shiuan Huei Lin, Yi Hsin Lin and Ken Yuh Hsu, "All optically controlled light valve assembled by photorefractive crystal and PDLC hybrid structure", **SPIE** v. 9508, doi: 10.1117/12.2178985 (2015)
<https://www.spiedigitallibrary.org/conference-proceedings-of-spie/9508/950800/All-optically-controlled-light-valve-assembled-by-photorefractive-crystal-and/10.1117/12.2178985.short>

C. Papers published in Conference Proceedings

1. Stefan Petrov, Vera Marinova, Shiuan Huei Lin, Yi Hsin Lin, Peichen Yu and Ken Yuh Hsu "Large Scale Liquid Crystal Device with Graphene-based Electrodes" *Proceeding of Optics and Photonics OPTIC Taiwan*, Paper No. 2017-FRI-S0404-O003 (2017)
2. V. Marinova, Y. C. Su, C. C. Chiou, S. Petrov, Ch. Dikov, D. Dimitrov and S. H. Lin "Hybrid organic/inorganic devices for display applications", *Photonica 2017, VI International School and Conferences on Photonics*, Proceeding, page 139, Belgrade, Serbia, 28 Aug-1 Sept (2017)
3. D. Z. Dimitrov "Sb-based phase change materials", *Photonica 2017, VI International School and Conferences on Photonics*, Proceeding, page 139, Belgrade, Serbia, 28 Aug-1 Sept (2017)
4. Vera Marinova, Shiuan Huei Lin, Stephan Petrov, Chia Ming Chang, Yi Hsin Lin, and Ken Yuh Hsu "Graphene Based LC Devices for Near Infrared Image Processing" *Optics and Photonics International Congress 2017, Information Photonics*, Yokohama, Japan 19-21 April (2017)
5. Plamen PETKOV, Tamara PETKOVA "Ge containing optical thin chalcogenide films" 2017 Global Conference on Polymer and Composite Materials, Guangzhou, China (2017)
6. P. Petkov, A. Stoilova, T. Petkova "Advanced Chalcogenide and Oxide Materials for Multifunctional Applications" First Moroccan spring school on advance materials MoSSAM'1, Marakesh, Marocco April 18-20 (2018)
7. P. Petkov, V. Zhelev, T. Petkova "Tin and Indium Oxide Films for Use as Large Area Position Sensitive Photodetector" Third International Symposium on Dielectric materials and applications (ISyDMA 2018) Beni Mellal Morocco, April 17-20 (2018)
8. Vera Marinova, Ren C. Liu, Zong F. Tong, Yi C. Lai, Ming S. Chen, Shiuan H. Lin, Yi H. Lin, Peichen Yu, Gou C. Chi and Ken Y. Hsu "Hybrid light valve device with graphene-based electrodes" *OPTIC 2015, Proceeding of Optics and Photonics Taiwan* (2015)
9. Vera Marinova, Ren C. Liu, Zong F. Tong, Shiuan H. Lin and Ken Y. Hsu "All-Optically Controlled Hybrid Structure Assembled by Bi₁₂SiO₂₀ Crystal and PDLC Layer" *OPTIC 2015, Proceeding of Optics and Photonics Taiwan* (2015)
10. V. Marinova, C. H. Chi, S. H. Lin, R. C. Liu and K. Y. Hsu "A novel type of all optically



addressed spatial light modulator for holographic display” 10-th International symposium of display holography, Conference proceeding, St. Petersburg 28 June-3 July (2015)

11. Vera Marinova, Etienne Goovaerts, Ren Chung Liu, Shiuan Huei Lin, Yi Hsin Lin and Ken Yuh Hsu “All optically controlled organic-inorganic hybrid device”, 4-th International Conference on the Physics of Optical Materials and Devices, Budva, Montenegro, August 31st – September 4th, (2015)

D. Conferences, organized with the financial support of project DFNI T02/26

1. “Advanced Optical Materials and Technologies” ICAOMT 2018 Borovetz, 27-29 April (2018)
2. “4-th International Conference on Oxide and Non-Oxide Materials for Optoelectronics and Energy Application, ICONMO Borovetz, 26-29 March (2017)
3. “3-th International Conference on Oxide and Non-Oxide Materials for Optoelectronics and Energy Application, ICONMO Borovetz, 01-04 December (2015)

E. Talks and poster presentations at International conferences

1. Shiuan Huei Lin, Vera Marinova and Ken Yuh Hsu “Organic-inorganic hybrid structure for high-resolution spatial light modulator, PAPER NUMBER: 10557-12, **invited talk**- SPIE Photonics West OPTO, Ultra-High-Definition Imaging Systems Conference 10557, 27 Jan - 1 Feb San Francisco, USA (2018)
2. P. Petkov, A.Stoilova, T. Petkova “Advanced Chalcogenide and Oxide Materials for Multifunctional Applications” First Moroccan spring school on advance materials MoSSAM’1 , Marakesh, Morocco April 18-20 (2018) - **invited talk**
3. P.Petkov, V.Zhelev, T.Petkova “Tin and Indium Oxide Films for Use as Large Area Position Sensitive Photodetector” Third International Symposium on Dielectric materials an applications (ISyDMA 2018) Beni Mellal Morocco, April 17-20 (2018) –**invited talk**
4. Stefan Petrov, Vera Marinova, Shiuan Huei Lin, Yi Hsin Lin, Peichen Yu and Ken Yuh Hsu “Large Scale Liquid Crystal Device with Graphene-based Electrodes” International Conference of Optics and Photonics Taiwan, OPTIC 2017 **oral talk**, Paper No. 2017-FRI-S0404-O003 (2017) Kaoshung Taiwan 07-09. Dec2017 (2017)
5. V. Marinova, Y. C. Su, C. C. Chiou, S. Petrov, Ch. Dikov, D. Dimitrov and S. H. Lin “Hybrid organic/inorganic devices for display applications”, Photonica 2017, VI International School and Conferences on Photonics, , Belgrade, Serbia, 28 Aug-1 Sept (2017)-**oral talk**
6. V. Marinova, Ch. Dikov and D. Dimitrov “Hybrid organic/inorganic devices based on Graphene and related 2D materials” COST Action 1402 HERALD workshop, Belgrade, Serbia, 29 Aug–30 Sept (2017)-**keynote talk**
7. Vera Marinova, Shiuan Huei Lin, Stephan Petrov, Chia Ming Chang, Yi Hsin Lin and Ken Yuh Hsu “Graphene based LC devices for near infrared image processing” ANM 2017, III International Conference on Graphene Advanced Materials, Aveiro, Portugal, 18-21 July (2017)-**oral talk**



8. Marinova Vera, Lin, Huei Shiuan and Hsu, Yuh Ken "Graphene-Based Optically Addressed Spatial Light Modulators" Applied Optics and Photonics China 2017 (AOPC 2017) 4-6 June 2017, Beijing, China –**oral presentation**
9. Vera Marinova, Shiuan Huei Lin, Stephan Petrov, Chia Ming Chang, Yi Hsin Lin, and Ken Yuh Hsu "Graphene Based LC Devices for Near Infrared Image Processing" Optics and Photonics International Congress 2017, Information Photonics, Yokohama, Japan 19-21 April (2017) (<http://opicon.jp/conferences/ip17/>) - **oral presentation**
10. Plamen PETKOV, Tamara PETKOVA "Ge containing optical thin chalcogenide films" 2017 Global Conference on Polymer and Composite Materials, Guangzhou, China (2017) – **invited talk**
11. Vera Marinova, Shiuan Huei Lin, Zhon Fang Tong, Stefan Petrov, Yi Hsin Lin, Peichen Yu and Ken Yuh Hsu "Graphene based optically addressed spatial light modulator devices" Proceeding of Optics and Photonics Taiwan OPTIC (2016) paper 270874, Taipei 3-5 Dec 2016 (<https://www.tl.ntu.edu.tw/2016/optic2016/>) - **poster presentation**
12. Stefan Petrov, Zhon Fang Tong, Vera Marinova, Shiuan Huei Lin, Yi Hsin Lin, Peichen Yu and Ken Y. Hsu "Fabrication of Large Area Liquid Crystal Device with Graphene-based Electrodes" Proceeding of Optics and Photonics Taiwan OPTIC (2016) paper 270888, Taipei 3-5 Dec 2016 (<https://www.tl.ntu.edu.tw/2016/optic2016/>) –**oral presentation**
13. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu "Graphene based organic-inorganic holographic elements and devices" International Workshop on Holography and related technologies (2016), Technical Digest p.30-32, Jiaoxi Taiwan, 11-13 Nov. 2016 -**invited talk**
14. Vera Marinova, Stefan Petrov, Shiuan Huei Lin and Ken Yuh Hsu "Sub-micron resolution in graphene oxide doped PDLC layer combined with inorganic photorefractive crystals" International Workshop on Holography and related technologies (2016), Technical Digest p.166-167, Jiaoxi Taiwan, 11-13 Nov. 2016 -**poster presentation**
15. Shiuan Huei Lin, Lun Kuang Lin, Vera Marinova and Ken Y. Hsu "Optical data storage using volume polarization hologram" International Workshop on Holography and related technologies (2016), Technical Digest p.158-159, Jiaoxi Taiwan, 11-13 Nov. 2016 **invited talk**
16. Shiuan Huei Lin, Vera Marinova and Ken Y. Hsu "Doped polymer materials for volume holograms and applications" International Workshop on Photonics Polymer for Innovation IWPPi Tochigi, Japan 11-14 Oct (2016) –**invited talk**
17. Bozhinov N, Blagoev B, Marinova V, Babeva T, Goovaerts E, Dimitrov D "Properties of ALD Aluminum-doped ZnO as transparent conductive oxide" Перспективни материали и технологии, IOMT scientific meeting, 10-11 Oct. (2016)-**poster presentation**
18. Vera Marinova, Shiuan Huei Lin and Ken Yuh Hsu "Electro-optically and all-optically addressed spatial light modulators based on organic-inorganic hybrid structures" **oral presentation** SPIE Photonics Asia, Beijing, China, 12-15 Oct. (2016)
19. Vera Marinova, Zhon Fang Tong, Stefan Petrov, Daniela Karashanova, Yi Hsin Lin, Shiuan Huei Lin and Ken Yuh Hsu "Graphene oxide doped PDLC films for all optically controlled light valve structures" **oral presentation** SPIE Optics & Photonics, San Diego, California, USA 28 Aug - 1 Sept (2016)



20. V Marinova, Z F Tong, S Petrov, S H Lin, M S Chen, Y H Lin, Y C Lai, P Yu and K Y Hsu "Liquid crystal cell with graphene electrodes " **oral presentation** 19th Int School on Condensed Matter Physc.,Varna, August 28th – September 2nd (2016)
21. D Dimitrov, P Rafailov, V Marinova, T Babeva, E Goovaerts, Y F Chen, C S Lee, and J Y Juang "Structural and optical properties of LuVO₄ single crystals" **poster presentation** 19th Int School on Condensed Matter Physc.,Varna, August 28th – September 2nd (2016)
22. V. Marinova, R. C. Liu, M. S. Chen, Shiuan Huei Lin, Yi Hsin Lin and Ken Yuh Hsu, "All optically controlled light valve assembled by photorefractive crystal and PDLC hybrid structure", SPIE Conference, SPIE Optics & Optoelectronics, Prague, Czech Republic,13-16 April (2015) –**oral talk**
23. V. Marinova, C. H. Chi, S. H. Lin, R. C. Liu and K. Y. Hsu "A novel type of all optically addressed spatial light modulator for holographic display" 10th International Symposium of Display Holography, St. Petersburg, Russia, 28 June-3 July (2015)–**poster presentation**
24. Vera Marinova, Etienne Goovaerts, Ren Chung Liu, Shiuan Huei Lin, Yi Hsin Lin and Ken Yuh Hsu "All optically controlled organic-inorganic hybrid device", 4th International Conference on the Physics of Optical Materials and Devices, Budva, Montenegro, August 31st – September 4th, (2015) –**oral talk**
25. V. Marinova, C. H. Chi, Z. F. Tong, N. Berberova, R. C. Liu, S. H. Lin, Y. H. Lin, E. Stoykova and K. Y. Hsu "Liquid crystal light valve operating at near infrared spectral range" Vth International School and Conference on Photonics - Photonica 2015, Belgrade, Serbia, 24-28 August (2015) –**poster presentation**
26. Nataliya Berberova, Dimana Nazarova, Lian Nedelchev, Blaga Blagoeva, Desislava Kostadinova, Vera Marinova, Elena Stoykova, "Photoinduced variation of the Stokes parameters of light passing through thin films of azopolymer based hybrid organic/inorganic materials" 19th International Summer School on Vacuum, Electron and Ion Technologies VEIT 2015, Sozopol, Bulgaria 21-25 September (2015)–**poster presentation**
27. Lian Nedelchev, Dimana Nazarova, Nataliya Berberova, Georgi Mateev, Veronica Salguirino, David Schmool, "Enhanced photoanisotropic response in azopolymer doped with elongated goethite nanoparticles", 19th International Summer School on Vacuum, Electron and Ion Technologies VEIT 2015, Sozopol, Bulgaria 21-25 September (2015)–**poster presentation**
28. Vera Marinova, Nataliya Berberova, Chen H. Chi, Zhong F. Tong, Yi C. Lai, Shiuan H. Lin, Yi H. Lin, Peichen Yu and Ken Y. Hsu "Organic – inorganic hybrid device with graphene – based electrodes for optoelectronic applications" 3-th International Conference on Oxide and non-Oxide materials for optoelectronics and energy application (ICONMO), Borovetz, 1-4 Dec (2015)–**oral talk**
29. L. Nedelchev, D. Nazarova, N. Berberova Hybrid organic/inorganic materials (HOIM) with enhanced optical response 3-th International Conference on Oxide and non-Oxide materials for optoelectronics and energy application (ICONMO), Borovetz, 1-4 Dec (2015)–**invited talk**
30. Vera Marinova, Ren C. Liu, Zong F. Tong, Yi C. Lai, Ming S. Chen, Shiuan H. Lin, Yi H. Lin, Peichen Yu, Gou C. Chi and Ken Y. Hsu "Hybrid light valve device with graphene-based



electrodes" OPTIC'2015, *Optics and Photonics Taiwan*, Dec 1-6 (2015) –**oral talk**

31. Vera Marinova, Ren C. Liu, Zong F. Tong, Shiuan H. Lin and Ken Y. Hsu "All-Optically Controlled Hybrid Structure Assembled by Bi₁₂SiO₂₀ Crystal and PDLC Layer" OPTIC'2015, *Optics and Photonics Taiwan*, Dec 1-6 (2015) - **poster presentation**
32. Vera Marinova, Shiuan Huei Lin, Yi Hsin Lin and Ken Y. Hsu "Hybrid organic-inorganic holographic elements" International Workshop on Holography and related technologies (IWH 2015), Okinawa, Japan, 1-3 Dec (2015) -**invited talk**
33. Zhong-Fan Tong, Shiuan Huei Lin, Vera Marinova, Ming-Syuan Chen, Yi-Hsin Lin, Yi-Chun Lai, Peichen Yu, and Ken Y. Hsu "Graphene-based liquid crystal device fabricated by photo alignment technique" International Workshop on Holography and related technologies (IWH 2015), Okinawa, Japan, 1-3 Dec (2015) –**poster presentation**
34. K. Lazarova, R. Georgiev, M. Vasileva, B. Georgieva, M. Spassova and T. Babeva, "One-dimensional hybrid photonic crystals for sensing applications", 5th International School and Conference on Photonics, August 24 - 28, (2015), Belgrade, Serbia – **poster presentation**
35. K. Lazarova, R. Georgiev, M. Vasileva, B. Georgieva and T. Babeva, "Color sensing using multilayered system comprising PMMA and V₂O₅", 17th International Workshop on Nanoscience and Nanotechnology, NANO 2015, 27 - 28 November 2015, Sofia, Bulgaria – **poster presentation**

F. Conference attendances supported by the project T-02/26

1. "Advanced Optical Materials and Technologies" ICAOMT 2018 Borovetz, 27-29 April (2018)
2. "4-th International Conference on Oxide and Non-Oxide Materials for Optoelectronics and Energy Application, ICONMO Borovetz, 26-29 March (2017)
3. "3-th International Conference on Oxide and Non-Oxide Materials for Optoelectronics and Energy Application, ICONMO Borovetz, 01-04 December (2015)
4. First Moroccan spring school on advance materials MoSSAM'1, Marakesh, Marocco April 18-20 (2018) и Third International Symposium on Dielectric materials an applications (ISyDMA 2018) Beni Mellal Morocco, April 17-20 (2018) **invited talk** –Prof. P. Petkov
5. VI International Conference PHOTONICA 2017 and workshop COST 1402, Belgrade, Serbia 28 Aug 2017 - 1 Sept 2017. **Oral Talk (Photonica) & Keynote Talk (COST meeting)**-Vera Marinova
6. VI International Conference PHOTONICA 2017 and workshop COST 1402, Belgrade, Serbia 28 Aug 2017 - 1 Sept 2017. **Poster (Photonica) & Keynote Talk (COST meeting)**-D. Dimitrov
7. Advanced Nano Materials, Aveiro, Portugal, 18.07.2017 - 24.07.2017. – **oral talk & Section Chair** –V. Marinova
8. Peter Rafailov visit at National Chiao Tung Univeristy, Taiwan - 18.04.2017 -24.04.2017-**talk**
9. Global Conference on Polymer and Composite Materials, Guangzhou, China 23-25 May



(2017) –**invited talk** -Prof. P. Petkov

10. Int School on Condensed Matter Physc, Varna, Bulgaria, 28th August – 2nd September 2016 –**oral talk** –V. Marinova
11. Photonica 2015, Belgrade, Serbia, 24-28 August (2015) –**poster presentations** -PhD students Natalia Berberova (**best presentation award**) and Katerizna Lazarova
12. International Summer School on Vacuum, Electron and Ion Technologies VEIT 2015, Sozopol, Bulgaria 21-25 September (2015)- 2 **poster presentations**- Natalia Berberova
13. IV International Conference on the Physics of Optical Materials and Devices, Budva, Montenegro, August 31st – September 4th, (2015) –**oral talk**-V. Marinova
14. “Oxide and non-Oxide materials for optoelectronics and energy application” (ICONMO), Borovetz, 1-4 Dec (2015)– **invited talk**- Natalia Berberova
15. “European Conference on Surface Crystallography and Dynamics”, Trieste, Italy, 18-21 October (2015) –**oral talk**-**Prof. P. Petkov**



Main results from the research project

Inorganic, photorefractive crystals of bismuth silenite $\text{Bi}_{12}\text{SiO}_{20}$ (BSO) and bismuth titanate $\text{Bi}_{12}\text{TiO}_{20}$ (BTO), doped with transition metal impurities, were grown with very high optical quality. From the performed optical measurements, it was found that doping with Ru and Rh significantly shift the photosensitivity to the infrared spectrum range in comparison with non-doped crystals. Holographic recording was performed using two-wave mixing set-up in real-time at 1064 nm. It was found that Ru and Rh significantly improve the photosensitivity and response time, with the holographic parameters being altered by controlling the valence states of impurities and excitation light. For Rh-doped BTO, a response time of 0.02 s was measured, which is one of the highest values reported so far in the literature.

Optimal conditions of mono- and multilayer graphene deposition on Cu foil by using CVD method are determined. A technological sequence of the layers' control processes has been developed by appropriately regulating the flow of reaction gases in the chemical deposition reactor. Graphene quality has been characterized by atomic-force microscopy (AFM), scanning electron microscopy (SEM), Raman spectroscopy, optical transmission and electrical measurements. The graphene-polyamide interface (alignment layer in liquid crystals) was also investigated by measuring the contact angle between graphene-polyamide and the hydrophobic properties of graphene. The obtained graphene layers are adapted as transparent conducting electrodes for spatial light modulation and other hybrid devices.

Transparent and conductive As-doped SnO_2 layers were obtained by spraying alcoholic aqueous solutions of potassium chlorides onto heated glass and silicon pads. The investigations made allow for layers with high visibility in the visible area and low electrical resistance suitable for contact layers in hybrid structures.

The effect of graphene, graphene oxide and reduced graphene oxide nanoparticles on morphology and electro-optical characteristics of liquid crystal (LC) and polymer-dispersed liquid crystal (PDLC) were studied in order to reduce the driving voltage as well as to support pre-orientation of liquid crystal molecules.

On the basis of performed investigations, hybrid structures consisting of a combination of inorganic crystal liquid crystals (or polymer dispersed liquid crystals (PDLC)) have been developed and demonstrated to allow the modulation of the refractive index to be controlled in a dynamic mode: electro-optically or all optically.

The functionality of graphene in developed hybrid structures (spatial light modulators) are demonstrated by dynamic image processing in the near infrared range, by recording and reconstruction a video (movie).