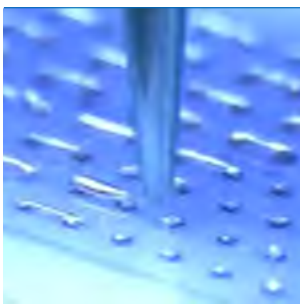
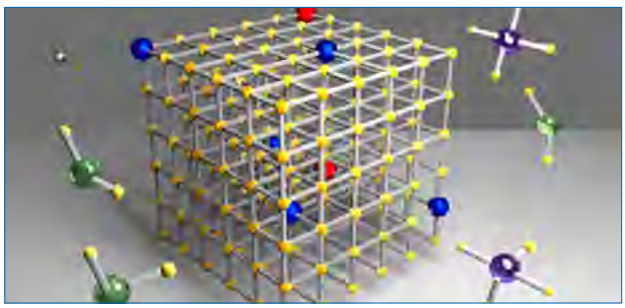
Accepted Abstracts

Nanomaterials Congress 2022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Ground source heat pump system for buildings heating and cooling

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Geothermal heat pumps (GSHPs), or direct expansion (DX) ground source heat pumps, are a highly efficient renewable energy technology, which uses the earth, groundwater or surface water as a heat source when operating in heating mode or as a heat sink when operating in a cooling mode. It is receiving increasing interest because of its potential to reduce primary energy consumption and thus reduce emissions of the greenhouse gases (GHGs). The main concept of this technology is that it utilizes the lower temperature of the ground (approximately <32°C), which remains relatively stable throughout the year, to provide space heating, cooling and domestic hot water inside the building area. The main goal of this study is to stimulate the uptake of the GSHPs. Recent attempts to stimulate alternative energy sources for heating and cooling of buildings has emphasized the utilization of the ambient energy from ground source and other renewable energy sources. The purpose of this study, however, is to examine the means of reduction of energy consumption in buildings, identify GSHPs as an environmentally friendly technology able to provide efficient utilization of energy in the buildings sector, promote using GSHPs applications as an optimum means of heating and cooling, and to present typical applications and recent advances of the DX GSHPs. The study highlighted the potential energy saving that could be achieved through the use of ground energy sources. It also focuses on the optimization and improvement of the operation conditions of the heat cycle and performance of the DX GSHP. It is concluded that the direct expansion of the GSHP, combined with the ground heat exchanger in foundation piles and the seasonal thermal energy storage from solar thermal collectors, is extendable to more comprehensive applications.

Recent Publications

1. Performance, Modelling, Measurement and Simulation of Energy Efficiency for Heat Exchanger, Refrigeration and Air Conditioning January 2022, Sustainable Energy Development and Innovation (pp.157-176), DOI:10.1007/978-3-030-76221-6_23

2. Analytical Studies of Energy Efficiency Development of the Greenhouses, Abdeen Mustafa Omer, ISSN: 2754-477X Sep 2021

3. A prescription for improvement: Health and Safety Measures, Abdeen Mustafa Omer, 2020.

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Collective effects in Si-based quantum dot nanomaterials to tune the functionality of nano electronic and nanophotonic components

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The approaches to obtaining high-performance infrared photodetectors and luminescent structures based on Ge/Si QDs silicon Nano heterostructures coupled with metal surfaces and photonic crystals are considered. It was shown that the composite Meta surface consisted of a two-dimensional regular array of silicon pillars and subwavelength holes array in a periodically perforated gold film on top of the detector active region displaying about 15 times peak responsivity enhancement at a wavelength of 4.4 μm relative to the bare detector. The planar Ge/Si QDs photodetector coupled with a plasmonic structure consisting of a two-dimensional regular array of Al nano disks can increase the photodetectors efficiency by about 40 times at λ=1,2 μm and by 15 times at λ= 1,55 μm with an appropriate choice of the array periodicity and the size of the Al nano disks. The other idea of the approach is to use photonic crystals in processes of optical absorption in thin layers of quantum dots embedded in photonic crystals. We found that the incorporation of Ge/Si quantum dot layers into a two-dimensional photonic crystal leads to multiple (up 34 times) enhancement of the photocurrent in the near-infrared range. The results are explained by the excitation of planar photonic crystal modes by the incident light wave propagating along with the Ge/Si layers and effectively interacting with interband transitions in quantum dots. The photoluminescence of the combined Ge/Si QDs heterostructures consisted of a combination of large (200–250 nm) GeSi nano disks and layered stacks of compact groups of smaller (30 nm) quantum dots were grown by site-controlled nucleation in the strain fields of nano disks show the multiple increases in the photoluminescence intensity. The main channels of radiative recombination correspond to spatially direct optical transitions.

The work was funded by the Russian Scientific Foundation (grant 19-12-00070).

Recent Publications

1. A. V. Dvurechenskii, Andrew Yakimov, V. V. Kirienko, Aleksey Bloshkin- Near-infrared photoresponse in Ge/Si quantum dots enhanced by localized surface plasmons supported by aluminum nanodisks October 2020Journal of Applied Physics 128(14):143101, Doi/10.1063/5.0023249

2. A. V. Dvurechenskii, Andrew Yakimov, Aleksey Bloshkin- Plasmonic Field Enhancement by Metallic Sub wave Lattices on Silicon in the Near-Infrared Range September 2019JETP Letters 110(6):411-416- DOI:10.1134/S0021364019180115

3. A. V. Dvurechenskii, Andrew Yakimov, Aleksey Bloshkin- Plasmon Enhancement of the Electric Field in Mid-Infrared Ge/Si Quantum-Dot Photodetectors with Different Thicknesses of the Active Region February 2019Semiconductors 53(2):195-199 DOI:10.1134/S1063782619020039

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A Three-Dimensional-reconstruction-based study on the ocular volume of Chinese children with high myopia

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Highly myopic eyes differ in morphology from emmetropic eyes, and the correct estimation of the vitreous volume is difficult. To explore an effective method to estimate ocular volume using refractive factors in children. Methods: This is a retrospective study of children with high myopia who visited the Shenzhen Shekou People's Hospital (July-December 2018) before undergoing posterior scleral reinforcement surgery. Data on refractive factors and ocular 3D reconstruction imaging based on high-end CT were collected for linear correlation and linear regression analyses.

Results: Ten patients (20 eyes) were included. There are nine males and one female. They were 4 to 12 years of age. The spherical equivalent ranges from +0.25 to -20.00 D. The cylindrical equivalent ranges from -0.50 to -6.25 D. The AL (axial length, AL) ranges from 21.78 to 33.90 mm. The corneal curvature (mean) ranges from 42.44 to 46.75. The 3D reconstruction of the CT images shows that the ocular volume ranges from 4.591 to 10.988 ml. The ocular volume of the 20 eyes decreases with the increase of diopter and total curvature, both presenting a linear trend, with the Pearson correlation coefficients being -0.776 (P<0.001) and -0.633 (P=0.003), respectively. The ocular volume of the 20 eyes increases with the increasing AL, also presenting a linear trend, with the Pearson correlation coefficient being 0.939 (P<0.001).

Conclusions: In children, the ocular volume is negatively and linearly correlated with the diopter and curvature, and positively and linearly correlated with the AL.

Recent Publications

1. Jiang X, Zhou Y, Ke P, Bao X, Wu H, Xia Y, Zhang Z, Zhong H, Dai Q, Wu L, Wang T, Lin M, Li Y, ang Q, Lu Y, Zhong X, Han M, Gao J. Peptide nano-blanket impedes fibroblasts activation and subsequent formation of pre-metastatic niche, 2022 May 25;13(1):2906. Doi: 10.1038/s41467-022-30634-8.

2. Xin Jiang, YuShuang Xu, LiNa Xiong, YaNan Li, ZhiFan Xiong- Diagnostic methods and drug therapies in patients with ischemic colitis, 2021 Jan;36(1):47-56. Doi: 10.1007/s00384-020-03739-z. Epub 2020 Sep 16.

3. Xiangyan Jiang, Zeyuan Yu, Long Qin, Haixiao Deng, Jianli Wang, Wen Ren, Hongbin Li, Lei Zhao, Huanxiang Liu, Hong Yan, Wengui Shi, Qi Wang, Changjiang Luo, Bo Long, Huinian Zhou, Hui Sun, Zuoyi Jiao- A novel UBE2T inhibitor suppresses Wnt/β-catenin signaling hyperactivation and gastric cancer progression by blocking RACK1 ubiquitination, 2021 Feb;40(5):1027-1042. Doi: 10.1038/s41388-020-01572-w. Epub 2020 Dec 15.

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