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Nanophotonics - A Novel Approach towards Optics

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ABSTRACT

According to the different scientific communities, the field of nanotechnology is very emerging and is regarded crucial to the 21st century. Due to this technological advancement, various fields including physics, biology, chemistry, and even the disciplines of medical and engineering has contributed cooperatively to the new knowledge of nanophotonics particularly by reaching at the nanoscale. Nanophotonics encompasses thedesign of existing optical electronic gadgets with improved functionality and novelfeatures that can be used in a diverse array of applications.

Keywords: *Semiconductors; Metallic mirrors; Sensors, Nanocavities; Photonic stones.*

INTRODUCTION

Nanophotonics is referred to as the technology which involves the interaction of light with smaller nanosized structures [1].it is mainly concerned with the controlled discharge of photons utilizing nano materials and study of their behaviour at nanoscale [2].With the progressive advancement in nanotechnology, nanophotonics emerges as a novel field that opened the possibilities for improved applications such as increased light yield of high brilliance LEDs [3],reduced assemblage cost of sun based cells [4], enhanced fluidic sensor arrangements [5] etc. Nanophotonics supports various fascinating themes such as integration of waves in semiconductors [6], confinement of photons to metallic mirrors [7], photonic stones [8], optical waveguides [9], micro resonators [10] etc. This technology is broadly divided into three categories which are as follow:

Nanoscale Confinement of Radiation

It is concerned with controlling the propagation of radiation and its interaction with matter [11].Based on this principle it can be used in designing applications such as photon scanning tunneling microscopy, near field optical microscopy, nanocavities, photon localization in photonic crystals etc [12,13].

Nanoscale Confinement of Matter

It is concerned with controllingenergy transfer, local interactions, optical resonance and excitation dynamics etc [14].Such principle are used in designing nanomaterials such as nanomers, nanodomains and nanocomposites [15, 16].

Nanoscale Photo-Processes

It controls spatial confinement of photochemical and photo physical processes to frame optical memory, sensors and actuators [17].

FABRICATION TECHNIQUES

Novel nanofabrication strategies have been adopted to design optical electronic/photonic gadgets with improved or novel functions [18].In order to manufacture nanophotonic gadgets, the choice of nanomaterial and its size is of great concern [19]. Conventional manufacturing is considered outdated due to its low throughput and high defilement that fails to meet the requirements [20]. Currently photochemical fume testimony method and photolithography is used as an innovative methods for designing photonic gadgets [21,22].

APPLICATIONS OF NANOPHOTONICS

Nanophotonics is a remarkable field since it consolidates logical difficulties with huge assortment of close term applications. Central research on nanophotonics prompts applications in the following areas:

- Information organizing over significant distances utilizes fiber optic systems [23]. Thus nanophotonics empowers transmission, equipped for associating effectively with current electronic systems [24].
- Designing optical PCs, an application which could have high effect by utilizing photonic associations between various processors that are incorporated on a circuit [25].
- Nanophotonics enhances electromagnetic radiation emission by improving the process of animated emanation in lasers [26].
- Designing solar cells that changes over the vitality of daylight straightforwardly into power by the photovoltaic impact [27].
- Nanophotonics introduces solid-state lighting that employs different types of diodes such as semiconductor light-transmitting diodes ,natural light radiating diodes, polymer light-producing diodes opposed to low performance electrical fibers and plasma [28, 29] and can be easily used in applications such as lithography, sensors and displays, light-activated medical therapies etc [30,31].

Challenges

Nanophotonics can possibly improve the functionality of optoelectronics in a wide array of novel applications. However there are various challenges ahead such as costly market methodologies, critical assessments of optoelectronic products, hierarchy of associations with other semi particles etc [32, 33].

Conclusion

Thus nanophotonics is an emerging field which requires a lot of research to explore its full potentials. It is still in infancy but promises advancements in the area of optics in the future.

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