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ชื่อผลงาน Gold Nano-particles Separation and Storage for Cosmetics, Healthcare and Beauty with Safety Usage

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(นายสุรภูมิ ตีระนันทน์)

นักวิชาการพาณิชย์ชำนาญการ

ปฏิบัติราชการแทนผู้อำนวยการสำนักลิขสิทธิ์

หมายเหตุ 1. เอกสารนี้มิได้รับรองความเป็นเจ้าของลิขสิทธิ์

2. การเปลี่ยนแปลงรายการข้างต้น ให้ดูด้านหลัง

Gold Nano-particles Separation and Storage for Cosmetics, Healthcare and Beauty with Safety Usage

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Abstract: A new system of gold nano-particle extraction, storage, trapping and injection is proposed using the micro-optical device and system. After gold thin sheet is heated and melted by a micro-optical heat source, the plasma gold particles can be flown into the guide pipe and collected within the storage tank. The circulation of gold particles is flown from top to the bottom tank levels, where there are some trapped gold particles feed into the output probes by the tunable laser. Eventually, there are some gold particles flown into the micro-plasma station, in which the next circulation of gold particle separation can be similarly operated. In applications, there are three probe types proposed, where there are modified Lasik technique, surface and internal injections, and embedded system, which they are useful for the use such as cosmetics, healthcare and beauty, where the concerned safety conditions are also discussed in details.

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Keywords: Nano life; Nanocosmetics; Healthcare and Beauty; Gold nano-particle; Nano-particle; Nano-medicine; Nanotechnology

1. Introduction

Nanoparticles have been widely used in healthcare and cosmetics for several years, where none acute toxic effect has been observed so far [1-4], where there is no evidence the environmental effects found in any location. Some tones of nanoparticles have been already used in some sunscreens [5, 6]. Gold nano-particle and human tissue effect are the important issues needed to clarify and safely confirmed, where in principle, the interaction between gold nano-particles and human tissues is formed as the following details. There are three methods of operations, where there are (i) the surface treathment, for instant, the cosmetics usage, (ii) the external injection, for instance, the gold particle injection using a Lasik system and (iii) the internal diganosis, for instance, for cancer treatments [7-10], where the detecting light pattern from different cancer cells are shown the diifferent patterns, which can be useful for cancer diagnosis and treatment. The nanoparticles can be combined(sticked) with the cancer cells, where the cancerous cells can be destroyed by the induced heated dissipation, which is harmless to the sourrounding healthy cells. The evidences of such treatments with the concern safety are found in the references [8, 9]. The use of gold nanoparticles for medical teeth and artificial skins are also plausible.

Nano-particles have been used in more and more products, where they can make the material benefits for such as stronger and lighter materials, cleaner surface, more resistant wear, road performance increasing, increasing medication efficiency. Gold nano-particles have been recognized as the important material ingredients that can offer the required material properties and suitably use for many applications [11-37]. According to the previous mentioned, where one of them is the healthcare usage, for instance, cancer treatment, fat release, cosmetics and beauty. Before the gold nanoparticles can be available for such an application, where there are few things such as (i) the preparation(synthesis methods), (ii) storage unit, (ii) treatment method. Till date, there are various synthesis methods are found in reference [3], in which the treatments are mostly used for healthcare and found in references [4-6], while the concerned safety is found in references [7-10]. Nanoparticles are being used in more and more consumer products. They can make materials stronger and lighter and make surfaces cleaner and more wear-resistant. They are increasing the performance of road vehicles, and are increasingly used in medicine to increase the efficiency of medication.

In this article, the new method of gold nanoparticle separation, storage and, treatments are proposed using the micro-optical system. The single gold atom is prepared and separated to be plasma clound by the micro-optical plasma source, in which the plasma contents are flown into the storage tank and

circulated after the cooling atoms are dropped from the hot to cold atom areas. The plasme particles can be trapped by the suitable tweezer and atom sizes, which can be used for the desire applications. There are three treatment methods, where they are Lasik, surface plasmon injection and internal treatment presented and discussed in details. The old fashion surface treatment mechanism is also review and discussed. The safety after treatments of those methods are also taken care and the concern issued presented.

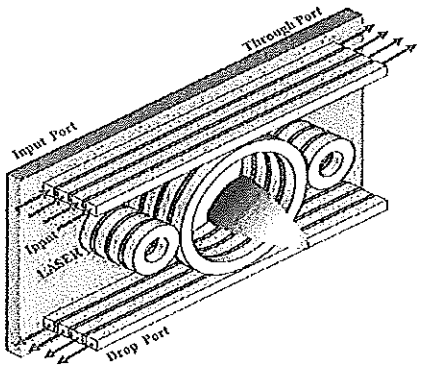
2. Extraction and Storage

In Figure 1, the gold particle atoms are excited by the micro-plasma source [38], the gold plasma vapors are distributed and flown into the guide pipe before entering into the storage tank. The switching power of micro-plasma source can be controlled by the input, through and drop ports, where commercial laser diode chip can be used and embedded to be a small chip. The output power is formed by the whispering gallery mode (WGM) as shown in Fig. 1(a), where the large scale the suitaplasma source can be fabricated and implemented. The gold plate is laid on the micro-plasma source surface, where the ionized gold atoms are flown into the guide pipe and storage tank, respectively.

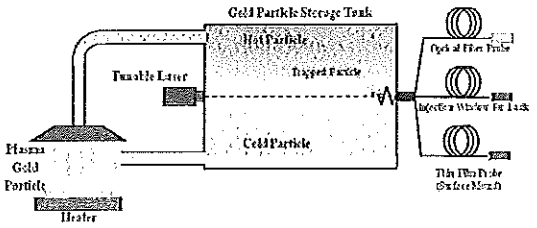
The circulation of hot and cold gold vapors is formed and cycle closed, which is ready for the nest circulation. Some of transition gold atoms can be trappesd and delivered to the atom probe units. The probe size can be tuned by the tunable laser source as shown in Fig. 1(b), whereble trapping tool can be controlled. The next round operation(circulation) can be controlled by the main switching(power switching) if the gold atoms are sufficient enough for the next round applications. In this system, there are three treatment methods, wher they are operated by optical fiber probe, Lasic and surface injection, which will be described in the following section. In Figure 1(c), the tunable laser probes(tweezers) can be tuned by the double vertical coupling ring resonator, which can be fabricated and embedded on chip, in which the desire trapping tool wavelength and size can be achieved.

3. Treatment Methods

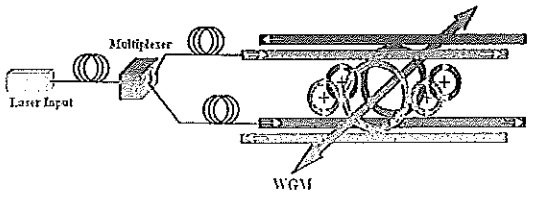
Naturally, The single gold atom size is ranged between 2-6 nm., where there are several methods of Gold particle separations, where they are chemical, electrical, optical methods and found descriptive details in reference [3]. In this work, the new scheme of particle extraction using a micro-plasma source is propsed. Finally, the gold atom cloud is circulated within the storage tank, which they are ready for trapping and injection by the optical tweezers(probes) [38]. The surface plasmon pulses are generated and used to trap the gold nanoparticles. The number of trapped gold atoms depends on the trapping tool size, where they are normally 20-50 nm [26]. In applications, the end of product life will be very difficult to prevent the release the nano-particles into the environment. As the size of the particle allows them to interact strongly with the biological structures, where there are all sort of potential human and environmental health issues associated with the build up of nano-waste in ecosystem.



(a) Micro-plasma source



(b) Micro-storage tank

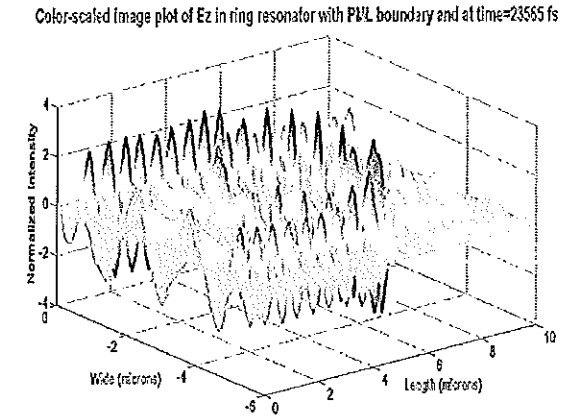


(c) Tunable gold nano-particle probe

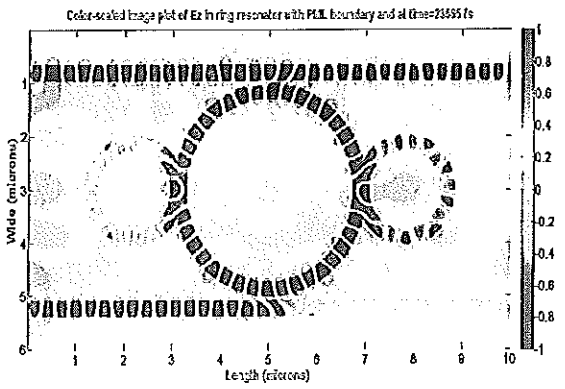
Figure 1: Schematic of gold nano-particle preparing, extraction, storage and applications, where (a) Micro-plasma source, (b) Micro-storage tank, (c) Tunable gold nano-particle probe

The nao-particle surface treatment has been popularly used in cosmetics, in which nano-particles can absorb light and penetrate into the facial tissue gaps, where the tissue spaces can be fulfilled and firmed by the nano-particles, especially, gold nano-particles, where the reflection of light can present the shiny face(surface). In Figure 2, the multiple tweezers

can be generated to use with the larger areas of thin film plate for facial polishment(injection), in which the nano-particles(gold atoms) and their combination can penetrate into the large facial tissue areas. The external treatment can be generated by using the well established Lasik system, in which the Lasik beam can be modified(applied) to connect with the gold nanoparticle storage tank. Finally, the trapped particles can be injected into the desire depths and locations.



(a)



(b)

Figure 2: Multi surface plasmon probes (tweezers) for multi trapping and injection usage, where (a) 3D image, (b) 2D image

The internal injection can also be similarly applied to the Lasik case but in this case the gold atoms can be delivered into the required accessed targets by the fiber optic probe, which can be useful for cancerous cells detection and therapy. In the cancer diagnosis and treatment, gold particles can be trapped and delivered into the closet are of the cancerous cells, the amount of light reflection between cancerous cells and light from gold particles depends on the cancerous cell types, which can lead the therapist diagnosis. While, the introduced heat dissipation of laser light into cancerous cells from gold atoms can kill the cancerous cell without any harm to the healthy cells. Moreover, the far infrared laser can excite human blood cells, where cells can have higher activities.

The possible design of new product for surface treatment using trapped gold nanoparticle can be applicable, in which the trapped particles can be combined with the cosmetic materials, where the injection of such materials can be penetrated into the required target areas and depths. The multi-trapped material mixture can also available by using the multi-trapping probes as shown in Fig. 2. The long life storage is the other advantage of the product due to the compact design of the storage tank, where the device size and design are the suitable to keep within the certain storage place. The particle injection density within the certain areas can be controlled which can lead to achieve the specific design usage, for instance, the facial treatments, where the V-shape requirement is the popularly needed.

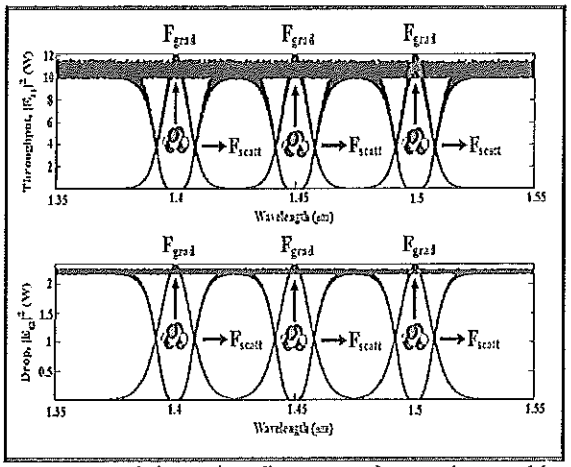


Figure 3: Schematic diagram of trapping gold nanoparticles by the optical capsules [39]

4. Discussion

The safety concern of using gold nanoparticles is very important, where there is no toxic report occurred so far when the gold nanopartice size is smaller than 10 nm, i.e. a sigle atom size(2-6 nm). In applications, the use of gold nanoparticles will be more and more increasing in demand, quality and human life. The use for cosmetics, beauty and healthcare will be more and more involved because there is no evidence of harmful so far, which is given by the above mentioned and references. The applications for such as healthcare and beauty, where the electrical charges(electrons) are generated and used for cell excitation, which can lead cell more active longer working hours, which is the good for working society and the world. In Figure 3,

the gold nano-particles are circulation within the storage tank, in which the desire trapped atom with the surface plasmon method can be selected and injected into the required targets and depths [39-41]. For cosmetics usage, all treatments such as surface, internal, external treatments can be employed under the medical care and therapist consultant.

5. Conclusion

The combination of gold nanoparticles can lead the larger forms of them, where the other forms and sizes of amouphouses and tubes can be originated, which they are the forms of black collid and micro-tubes, respectively. Although, the warning that the corporations around the world are rapidly introducing thousands of tons of nanomaterials into the environment and onto the faces and hands of millions of people, despite the growing body of evidence indicating that nanomaterials can be toxic to humans and the environment. Friends of the Earth believes that there are at least several hundred cosmetics, sunscreens and personal care products which contain engineered nanomaterials that are commercially available right now. There is no evidence wheather the use of cosmetic product with additional gold nanoparticles by **SOL**(SCI Center, SOL Corporation International Company Limited) is harmed the human health when it is used in normal and established conditions. Moreover, SOL researchers are currently researching and investigating on the applications of gold nanoparticles and colored stones in cosmetics in all aspects.

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References

1. M. Husain, A.T. Saber, C. Guo, N.R. Jacobsen, K.L. Yauk, A. Williams, U. Vogel, H. Wallin, S. Halappanavar, Pulmonary instillation of low doses of Titanium nanoparticles in mice leads to particle retention gene expression changes in the absence of inflammation, toxicology and applied phamacology, 269(3), 250-262, 2013.
2. K. Anderson, Assessing use of gold nanoparticles, Cosmetics & Toiletries, June 1, 2013.
3. N. Li, P. Zhao and D. Astruc, Anisotropic gold nanoparticles: Synthesis, properties, applications, and toxicity, Angew. Chem. Int. Ed. 2014, 53, 1756 – 1789.
4. D. Sykora, V. Kasicka, I. Miksik, P. Rezanka, K. Zaruba, P. Matejka, V. Kral, Applicatio of gold nanoparticles in separation sciences, J. Sep. Sci. 2010, 33, 372–387.
5. M. Guix, C. Carbonell, J. Comenge, L.G. Fernandez, A. Alarcon, E. Casals, Nanoparticle for cosmetics, How safe is safe ?, Contribution to Science, 4(2), 213-217, 2008.
6. S, Shoma Jose, U. S. Sumod, and M. Sabitha, Nanotechnology in cosmetics: Opportunities and challenges, J Pharm Bioallied Sci. 2012 Jul-Sep; 4(3): 186–193.
7. X. Huang, M. A. El-Sayed, Gold nanoparticle: Optical properties and implementations cancer diagnosis and photo-thermal therapy, J. Advanced Research, 1(1) 13-28, 2010.
8. A.J. Mieszawska, W.J.M Mulder, Z.A. Fayad, D.P. Cormode, Multifunctional gold nanoparticles for diagnosis and therapy of disease, Molecular Pharmaceutics, Mol Pharm. 2013 Mar 4;10(3):831-47.
9. K.S. Soppimath, G.V. Betageri and M.-H. Cho, Nano-sctructures for cancer diagnostics and therapy, edited by In K., C. Gonsalves et al., *Biomedical Nanostructures,* pp.409-437, 2008. New York: John Wiley & Sons, 409-437, 2008.
10. Y. Pellequer and A. Lamprecht, A., Nanoscale cancer therapeutics, edited by A. Lamprecht, *Nanotherapeutics: Drug delivery concepts in nanoscience,* Chicago: Pan Stanford Publishing, 93-24, 2009.
11. M. Bahadoran, A.F.A. Noorden, F.S. Mohaler, M.H.A. Mubin, K. Chaudhary, M.A. Jalil, J. Ali, P. Yupapin, Detection of Salmonella bacterium in drinking water using microring resonator, Artificial Cells, Nanomedicine and Biotechnology, 1-7, Posted online on 18 August 2014.
12. S. Tunsiri, N. Thammawongsa, S. Mitatha and P.P. Yupapin, Molecular transport network security using multi-wavelength optical spins, Artificial Cells, Nanomedicine and Biotechnology, 1-8, Posted online on 24 July 2014.
13. N. Thammawongsa, P.P. Yupapin, Remote artificial eyes using miro-optical circuit for long distance 3D imaging perception, Artificial Cells, Nanomedicine and Biotechnology, 1-5, Posted online on 20 May 2014.
14. K. Tamee, K. Chaiwong, K. Yothapakdee, P.P. Yupapin, Fringe patterns generated by micro-optical sensors for pattern recognition, Artificial Cells, Nanomedicine and Biotechnology, 1-6, Posted online on 22 May 2014.
15. J. Visessamit, K. Kulsirirat and P.P. Yupapin, High capacity and security molecular capsule transporters, Artificial Cells, Nanomedicine and Biotechnology, 1-8, Posted online on 7 Jan 2014.
16. F.D. Zainol, N. Thammawongsa, S. Mitatha, J. Ali and P.P. Yupapin, Nerve communication model by bio-cells and optical dipole coupling effect, Artificial Cells, Nanomedicine and Biotechnology, 41(8) 368-375, 2013.
17. M.A. Jalil, C.T. Ong, T. Saktioto, S. Daud, M.S. Aziz and P.P. Yupapin, Ultra-short laser pulse generated by a micrring resonator system for cancer cell treatment,

Artificial Cells, Nanomedicine and Biotechnology, 41(3) 152-158, 2013.
18. M.S. Aizi, B. Jukgoljan, S. Duad, T.S. Tan, J. Ali and P.P. Yupapin, Molecular filter on-chip design for drug targeting use, Artificial Cells, Nanomedicine and Biotechnology, 41(3) 178-183, 2013.
19. M.A. Jalil, J. Phelawan, M.S. Aziz, T. Saktioto, C.T. Ong, P.P. Yupapin, Acne vulgarism treatment using ultra-short laser pulse generated by micro-and-nanoring resonator system, Artificial Cells, Nanomedicine and Biotechnology, 41(2) 92-97, 2013.
20. N. Thammawongsa, S. Mitatha and P.P. Yupapin, An optical nano-antenna system design for radio therapeutic use, Artificial Cells, Nanomedicine and Biotechnology, 41(1) 21-26, 2013.
21. M.A. Jalil, S. Kamoldilok, T. Saktioto, C.T. Ong, P.P. Yupapin, Drug trapping and delivery for Alzheimer's diagnosis, Artificial Cells, Nanomedicine and Biotechnology, 40(5) 303-308, 2012.
22. M.A. Aziz, M.A. Jalil, N. Suwanpayak, J. Ali, P.P. Yupapin, Optical manipulation of nano-micro needle array for large volume molecular diagnosis, Artificial Cells, Nanomedicine and Biotechnology, 40(4) 266-270, 2012.
23. M.A. Jalil, K. Innate, N. Suwanpayak, P.P. Yupapin, J. Ali, Molecular diagnosis using multi drug delivery network and stability, Artificial Cells, Nanomedicine and Biotechnology, 49(6) 357-365, 2011.
24. S. Mitatha, N. Moongfangklang, M.A. Jalil, N. Suwanpayak, J. Ali and P.P. Yupapin, Multi-access drug delivery network and stability, International Journal of Nanomedicine, 6: 1757-1764, 2011.
25. N. Suwanpayak, M.A. Jalil, M.S. Aziz, J. Ali and P.P. Yupapin, Molecular buffer using a PANDA ring resonator for drug delivery use, International Journal of Nanomedicine, 6: 575-580, 2011.
26. N. Moongfangklang, M.A. Jalil, K. Innate, S. Mitatha, J. Ali, and P.P. Yupapin, Molecular network topology and reliability for multipurpose diagnosis, International Journal of Nanomedicine, 6: 2385-2392, 2011.
27. M.A. Jalil, N. Suwanpayak, K. Kulsirirat, S. Suttirak, J. Ali and P.P. Yupapin, Embedded nanomicro syringe on chip for molecular therapy, International Journal of Nanomedicine, 6: 2925-2932, 2011.
28. S. Mitatha, N. Moongfangklang, M.A. Jalil, N. Suwanpayak, T. Saktioto, J. Ali and P.P. Yupapin, Proposal for Alzheimer's diagnosis using molecular buffer and bus network, International Journal of Nanomedicine, 6: 1209-1216, 2011.
29. M.S. Aziz, N. Suwanpayak, M.A. Jalil, R. Jomtarak, T. Saktioto, J. Ali and P.P. Yupapin, Gold nanoparticle trapping and delivery for therapeutic applications, International Journal of Nanomedicine, 7: 11-17, 2012.
30. M.A. Jalil, A. Abdolkarim, T. Saktioto, C.T. Ong and P.P. Yupapin, Generation of THz frequency using PANDA ring resonator for THz imaging, International Journal of Nanomedicine, 7: 773-779, 2012.
31. N. Suwanpayak, M.A. Jalil, M.S. Aziz, F.D. Ismail, J. Ali and P.P. Yupapin, Blood cleaner on-chip design for artificial human kidney manipulation, International Journal of Nanomedicine, 6: 957-964, 2011.
32. C. Teeka, M.A. Jalil, J. Ali and P.P. Yupapin, Novel tunable dynamic tweezers using dark-bright soliton collision control in an optical add-drop filter, IEEE Transaction on Nanobioscience, 9(4), 258-262, 2010.
33. M.A. Jalil, T. Tasakorn, N. Suwanpayak, J. Ali and P.P. Yupapin, Nanoscopic volume trapping and transportation using a PANDA ring resonator for drug delivery, IEEE Transaction on Nanobioscience, 10(2), 106-112, 2011.
34. Y. Braham, H. Barhoumi, A. Maaref, N.J. Renault, Characterization of urea biosensor based on the immobilization of bacteria proteus mirabilis in interaction with iron oxide nanoparticles on gold electrode, J Biosensors and Bioelectronics, 5(4), 1000160, 2014.
35. S. Phunthawanunt and P.P. Yupapin, Drug delivery targeting security by optical capsule switching control, J Biosensors and Bioelectronics, 5(3), 1000158, 2014.
36. P.P. Yupapin, Simultaneous imaging of total cerebral hemoglobin concentration, oxygenation, and blood flow during functional activation, J Biosensors and Bioelectronics, 4(2), 1000132, 2013.
37. T. Saktioto, D. Irawan, N. Thammawongsa and P.P. Yupapin, Drug delivery system model using optical tweezer spin control, J Biosensors and Bioelectronics, 5(3), 1000159, 2014.
38. R. Siriroj, N. Thammawongsa and P.P. Yupapin, Micro energy source using WGMs of wave in a small optical device, Energy Procedia, 34, 1-8, 2013.
39. P.P. Yupapin and J. Vesessamit, Optical capsule: A secure micro-molecular transporter, Nanoscience Letters, 4(3), 36-41, 2014.
40. S.T. Malak, T. König, R. Near, Z.A. Combs, M.A. El-Sayed and Vladimir V. Tsukruk, Stacked gold nanorectangles with higher order plasmonic modes and top-down plasmonic coupling, The Journal of Physical Chemistry, February, 2014.
41. N. Suwanpayak, M.A. Jalil, C. Teeka, J. Ali and P.P. Yupapin, Optical vortices generated by a PANDA ring resonator for drug trapping and delivery applications Biomedical Optics Express, 2(1), 159-168, 2011.

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Gemstone Property Studies for Minerals Based Cosmetics and Beauty Applications

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Abstract: In this article, properties of various gemstones are investigated and discussed for the possibility of using as mineral based cosmetics usage. By using the separation technology, the single atom of various gemstones , for instance, Au and Ag are combined with tourmaline and some other gemstones, which can give the infrared spectrum and be useful for many applications, where in this work we concentrate on the gemstone optical properties that can be used incorporating the cosmetic materials and useful for surface usage. The optical properties such as absorption and transparent transmission, where the desired properties are suitable for cosmetic applications, which are also investigated and discussed in details.
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Keywords: Gemstones, Gemology; Optical gemology, Nano life; Nanocosmetics; Nano-medicine; Nanotechnology;

1. Introduction

Generally, there are three types of gemstones in record, firstly, they are mineral gemstones and found in rocks, where themselves are made up of one or more minerals. The three types of rocks are (i) igneous rocks, (ii) **sedimentary** rocks and (iii) metamorphic rocks. Secondly, organic gemstones-gemstones have their origin either from plants or from animals. Thirdly, they are synthetic gemstones are made in laboratories or factories. The important properties of gemstones that have to be accounted are (i) hardness, where the higher the hardness, more durable is the stone. Diamond is the hardest gemstone known and has been assigned hardness of 10 on Moh's scale of hardness, while the Talc has been given lowest hardness of 1 on this scale [1]. The gemstone hardness is rated in between 1 to 10, (ii) the specific gravity, which presents the density of the gemstone, where in common parlance it shows the weightiness of the gem. The greater the specific gravity, the heavier the gem will feel, (iii) the crystal shapes, this can give a definite clue about the gemstone internal structure and (iv) the optical properties, these are also used by researchers and experts to differentiate and decide about the ways of cutting and polishing the gems.

In cosmetics usage, optical material properties can be found in the form of material known as gemstones [1, 2], where there are broad selection of quality pearlescent micas, oxides, ultramarines and other ingredients used to formulate mineral makeup, where the beautiful blushes, bronzers, eye shadows, lip colors and more can be obtained by the mineral based cosmetics [3-5]. However, the desired gemstones are required to give two important properties for cosmetics, where one is the material separation that can be mixed(combined) minerals, for instance, Au or Ag to be the used ingredients, where the second one is the transmission(reflection) of light within the far infrared wavelength region, which can also be useful for therapeutic applications. In addition, the safety of gemstones with cosmetics usage is the very important issue that is needed to be accounted. Till date, there is not many research works in this area of research and investigation.

Materials based on optical properties have been the interesting and important materials for many applications, where the dominent properties of them are the transparent and dual properties, where the combination between electrical and optical properties are the keys of successfull usages. Firstly, the optical property is commonly used for the device that give light in broad spectrum, in which the various usages such as in medicine, healthcare and others [6-15] have been successfully implemented. Secondly, the use of electrical property is basically formed by the polarization of light within the device, in which the electrical property can be obtained and finally used. For instance, most of optical materials are required to change from optical property to electrical property by transferring from the polarization of light with in the device, however, there is one material family that can give the electrical properties directly, it is the graphene material family [16], which can lead to many applications for this decade.

In this article, we have proposed the use of gemstones in the far infrared wavelength region for

cosmetics applications. The use of Au and Ag where they are combined with tourmaline can be suitable for minerals based cosmetics [17, 18], where the infrared transmsision can be beneficial for therapeutic usage. In addition the safety issue is also given and discussed. To begin this knowledge, the basic background of gemstones that give the optical and electical properties are given in details. The safety of using minerals based cosmetics and beauty is also proposed and discussed with various methods and evidences.

2. Minerals Based Cosmetics and Beauty

Cosmetic textures are basically served the user requirements, however, they should offer a broad selection of quality pearlescent micas, oxides, ultramarines and other ingredients used to formulate mineral makeup. The criteria of using gemstones for cosmetics are particle sizes, physical properties and chemical properties that can be used for cosmetics, beauty and therapy. There are various gemstones that can offer the required properties, where they are tourmaline and some other gemstones, in which the far infrared(FIR) property can be obtained, which is in a powder form to make a mineral-based water prior to add Au & Ag nanoparticles, where the final output is the solution used. Since nanoparticles have been popularly used in cosmetics, which was reported by Yupapin and Suwandee [19], therefore, in this article we are going to concentrate on the combination between Au and Ag with the required gemstone properties, especially, the infrared wavelength region. The powder form of gemstones has been the suitable agents to add with the Au and Ag nanoparticle. Tourmaline is a crystalline boron silicat mineral compound with elements such as aluminium, iron, magnetism, sodium, lithium, or potassium, which is classified as semi-precious stone and the gemstone comes in variety of colors. There are found few locations in Thailand.

Infrared therapy can offer the non-operation treatment, which has been the popular method nowadays, where the various treatments in either inside or outside body can be formed, especially, for the treatment that requires heat to form the treatment. There are some evidences of infrared treatments have been reported [20-23]. For the surface treatment using tourmaline, the combination with Au and Ag is also interesting, in which the infrared transmission can be obtained by the tourmaline content within the mixture, which is available for heat treatment and therapy usage.

The suitable knowledge and technology that can be used to support the tourmaline for minerals based cosmetics and beauty can be described as following details. By using the same technique of drug delivery concept, the combination between Au or Ag and tourmaline can be formed, in which the atom size is only a slightly change, which means that the well known drug delivery technique can be implemented [13, 14, 19, 20]. In applications, the use of such contents such as internal, external and surface treatments can be done. The use for cosmetics is formed by the surface treatment can be described similarly to the recent reported work [19], where the internal and external treatments can also be used. The safety issue of using tourmaline in all aspects is also concerned, where so far there is no evidence of the risk in the environment.

3. Discussion and Conclusion

Tourmaline is claimed as the innert though the complex mineral. It has the piezoelectric property, which means that it generates an electrical charge when it is gone under pressure, so it can be used in pressure gauges. Tourmaline also has the pyroelectric property, where the electrical charge during a temperature change can be presented. Although, this is the concept paper based on the previous results, in which the use in technique can be done similarly to the Au and Ag particle usage. The electrical and thermal properties can give benefits for the applications such as cancer cells killer and acne treatments [23], while the magnetic property of particle has also been used in the magnetic sensors and therapy using the nano-scale device [24, 25]. Furthermore, there is no published research showing tourmaline has any proven effect on skin whatsoever.

In conclusion, we have presented the feasibility of using minerals based cosmetics and beauty, where the basic properties have been reviewed. The gemstone particle separation and mixture are discussed, where the interesting property that uses the infrared wavelength region is discussed for therapeutic usage. The safety of minerals based cosmetics and beauty is also proposed and discussed with various methods and evidences.

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References

1. W. Schumann, Gemstones of the World, 3rd edition, Sterling Publishing, New York, 2006.
2. R.W. Siegel, Vacancy Concentration in Metal, J. Nuclear Materials, 69 & 70, 117, 1978.
3. K. Anderson, Assessing use of gold nanoparticles, Cosmetics & Toiletries, June 1, 2013.

4. N. Li, P. Zhao and D. Astruc, Anisotropic gold nanoparticles: Synthesis, properties, applications, and toxicity, Angew. Chem. Int. Ed. 2014, 53, 1756 – 1789..
5. M. Guix, C. Carbonell, J. Comenge, L.G. Fernandez, A. Alarcon, E. Casals, Nanoparticle for cosmetics, How safe is safe ?, Contribution to Science, 4(2), 213-217, 2008.
6. M.S. Aziz, N. Suwanpayak, M.A. Jalil, R. Jomtarak, T. Saktioto, J. Ali and P.P. Yupapin, Gold nanoparticle trapping and delivery for therapeutic applications, International Journal of Nanomedicine, 7: 11-17, 2012.
7. J. Visessamit, K. Kulsirirat and P.P. Yupapin, High capacity and security molecular capsule transporters, Artificial Cells, Nanomedicine and Biotechnology, 1-8, Posted online on 7 Jan 2014.
8. M.A. Jalil, C.T. Ong, T. Saktioto, S. Daud, M.S. Aziz and P.P. Yupapin, Ultra-short laser pulse generated by a microring resonator system for cancer cell treatment, Artificial Cells, Nanomedicine and Biotechnology, 41(3) 152-158, 2013.
9. M.S. Aizi, B. Jukgoljan, S. Duad, T.S. Tan, J. Ali and P.P. Yupapin, Molecular filter on-chip design for drug targeting use, Artificial Cells, Nanomedicine and Biotechnology, 41(3) 178-183, 2013.
10. M.A. Jalil, J. Phelawan, M.S. Aziz, T. Saktioto, C.T. Ong, P.P. Yupapin, Acne vulgarism treatment using ultra-short laser pulse generated by micro-and-nanoring resonator system, Artificial Cells, Nanomedicine and Biotechnology, 41(2) 92-97, 2013.
11. M.A. Jalil, N. Suwanpayak, K. Kulsirirat, S. Suttirak, J. Ali and P.P. Yupapin, Embedded nanomicro syringe on chip for molecular therapy, International Journal of Nanomedicine, 6: 2925-2932, 2011.
12. M.A. Jalil, A. Abdolkarim, T. Saktioto, C.T. Ong and P.P. Yupapin, Generation of THz frequency using PANDA ring resonator for THz imaging, International Journal of Nanomedicine, 7: 773-779, 2012.
13. S. Phunthawanunt and P.P. Yupapin, Drug delivery targeting securirity by optical capsule switching control, J Biosensors and Bioelectronics, 5(3), 1000158, 2014.
14. T. Saktioto, D. Irawan, N. Thammawongsa and P.P. Yupapin, Drug delivery system model using optical tweezer spin control, J Biosensors and Bioelectronics, 5(3), 1000159, 2014.
15. R. Siriroj, K. Srinuanjan and P.P. Yupapin, Micro-plasma Source Design using WGMs in a PANDA ring, Advanced Materials Research, 979, 3-6, 2014.
16. T. Saktioto, D. Irawan, P.P. Yupapin and P. Phataracorn, Graphene dual properties, Mobility and polarisibility: The Challenge, J Biosensors and Bioelectronics, 5(3), 1000e130, 2014.
17. S.T. Malak, T. Konig, R. Near, Z.A. Combs, M.A. Ei-Sayed and V.V. Tsukruk, Stacked gold nanorectangles with higher order plasmonic modes and top-down plasmonic coupling, The Journal of Physical Chemistry C, 118(10), 5453-5462, 2014.
18. P.P. Yupapin and S. Suwandee, Gold nanoparticles separation and storage for cosmetics, healthcare and beauty usage, Life Sci J, 11(10), 1225-1229, 2014.
19. P.P. Yupapin and J. Vesessamit, Optical capsule: A secure micro-molecular transporter, Nanoscience Letters, 4(3), 36-41, 2014.
20. Y. Li, A.M. Gobin, G.W. Dryden, X. Kang, D. Xiao, S.P. Li, G. Zhang and RCG Martin, Infrared light-absorbing gold/gold sulfide nanoparticles induce cells death in esophageal adenocarcinoma, International Journal of Nanomedicine, 8, 2153-2161, 2013.
21. L. Fan, Q. Wu and M. Chu, Near infrared fluorescent chlorophyll nanoscale liposomes for sentinel lymph node mapping, International Journal of Nanomedicine, 7, 3071-3080, 2012.
22. S.B. Rizvi, S. Rouhi, S. Taniguchi, S.Y. Yang, M. Green, M. Keshtgar, A.M. Seifalian, Near-infrared quantum dots for HER2 localization and imaging of cancer cells, International Journal of Nanomedicine, 9, 1323-1337, 2014.
23. C.Y. Wu, C. Yu and M.Q. Chu, A gold nanoshell with a silica inner shell synthesized using lipsome templates for doxorubicin loading and near-infrared photothermal therapy, International Journal of Nanomedicine, 6, 807-813, 2011.
24. N. Thammawongsa, S. Mitatha and P.P. Yupapin, Optical spins and nano-antenna array for magnetic therapy, IEEE Transaction on nano-bioscience, 12(3), 228-232, 2013.
25. P.P. Yupapin, Optical spins generated by a modified add-drop filter for network sensors, Comprehensive Materials Processing, 13, 307-315, 2014.

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Drug Targeting Model of Composite Gold-Tourmaline for Cells Enhancing Applications

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Abstract:
The drug delivery and targeting method of gold tourmaline composite atoms generated by optical tweezers in a micro-optical device system is proposed. Gold atoms can be trapped and mixed into the tourmaline content, from which the composite gold tourmaline atoms can be formed using the optical tweezers, which can be delivered close to the desired target cells for cells healing and enhancing applications. In simulation, the optical tweezers are formed by whispering gallery (leaky) modes of light can be generated within a modified add-drop filter, which is known as a Panda ring resonator. It is a nonlinear micro optical device, from which the optical probes called optical tweezers can be generated and used for atom trapping, removing and transportation. In this paper, the optical tweezers are designed for gold tourmaline composite atom trapping, in which the trapped gold tourmaline atoms can be deposited (removed) on (from) the surface for cosmetics and cells enhancing treatment usages. The advantage of the proposed scheme is that the apply (remove) atoms to(from) the surface treatments by the designed trapping and storage device, where the device switching control is the key function. In application, the composite trapped gold-tourmaline atoms can be stored with the storage device. In addition, the removal trapped gold-tourmaline atoms can be removed from the treatment surface, from which the used gold atoms can be possible extracted and reused. The cells enhancing and healing applications using the tourmaline properties such as magnetic and far infrared are also plausible.

Keywords: Drug delivery; Cells enhancement; Cells healing; Bio-sensors diagnosis; Cosmetics; Tissue engineering;

1. Introduction

Optical microring resonator has been the interesting device for nano-communication and network for high speed, and compact devices for large-scale platform [1-5]. One of the popularly used devices is an optical add-drop filter, which consists of one input port, one microring resonator, and two output ports. Generally, a microring resonator serves as a selector for optical carriers and wavelengths. These three-port devices function as switches to route optical signals to different output ports, allowing further integration of various devices on the same platform. Currently, an optical add-drop filter device can be made to form the other usage, which has shown the convincing challenges for particle or molecule electronics, especially, after the practical trapping particle work has been strongly confirmed by Cai and Poon [6-9], where particle or molecule could be trapped and transported within the add-drop optical filter, from which the concrete concept of theoretical work has been confirmed [10], where various applications have been investigated and reported. Moreover, several researchers have also shown that the modified add-drop optical filter called a Panda ring resonator has more benefits than the ordinary add-drop filter [11-15], in which the two nonlinear side rings of the optical add-drop device are made from the nonlinear material types that can produce may aspects of applications, for instance, high channel capacity, fast switching time and wide sensing range of applications etc. In fabrication, the used nonlinear materials can be the grapheme material, AlGaAs/InP and others, which can be useful for many aspects of applications.

Gold nano-particle is recognized as an excellent candidate for nano-medicine applications, especially, for cancerous cells treatment, cells enhancement and treatment effect, where there were many theoretical and practical works reported [16-20], where the key concept of such technology is to use a single gold atom for drug delivery applications. Such a technique can be used and performed successfully by incorporating the optical trapping tools (tweezers), where the specific tweezer wavelengths and powers can penetrate without harm into the target cells and treatment surrounded areas, in which the treatment can be securely performed. Regarding to the successful gold atom treatment, therefore, there is the searching of new form of material that can be useful for medical treatment, diagnosis and therapy, where recently gemstones have become the interesting materials that can be considered to add into the nano-particle contents. In practice, the nano-particle based on material size is not much increased and changed from the nano-scale size. Naturally, one of the interesting gemstone families known as tourmaline has been found in various places [21-24], where the far infrared and magnetic properties are the key treatments of this material.

Tourmaline has been widely used in cosmetics business recently but there is no evidence of safety and toxic concerns. Tourmaline powder can be mixed with the gold nano-particles and applied for cells healing and enhancing applications [25-27], for instance, magnetic and aura therapies. The treatment of such material can be in the form or mixture powder for

cosmetics usage. However, there is no evidence of toxic of short period surface treatment, which may be the usage limitation. There are many types of tourmaline in nature, from which the black tourmaline is one of them that can give the interesting feature applications, which can be useful for the cells enhancement, healing and therapy, which can be categorized as followings, (i) healing therapies, (ii) physical healing energy, (iii) emotional healing energy, (iii) Chakra healing and balancing energy, (iv) spiritual energy, (v) color energy, (vi) meditation, angelic realm, (vii) divination, where more details can be found in the given references. Apart from the tourmaline surface treatment for cosmetics usage, there is another interesting aspect that the use of tourmaline characteristics may be realized and useful for deep skin layer cells enhancement, healing and therapy by using the drug delivery method. By using this method, the tourmaline powder can be mixed by the solid material atom, for instance, gold atom and delivered close to the target cells. The required target cells can be enhanced by the gold tourmaline composite atom, from which the target cells can be excited and exchanged in energy between the tourmaline and cells, which is useful for cells enhancing and healing. However, this is the proposed work that there is no evidence of tourmaline toxic occurred in the surface treatment for cosmetics usage. Thus, the safety and toxic concerns must be the serious problems of the deep skin layer, which will be the big issue of research and investigation within this decade.

In this paper, the optical trapping tools (tweezers) generation using whispering gallery(leaky) modes of light within a modified add-drop filter is modeled and simulated, where in addition the trapping force and drug delivery details are reviewed and presented. In application, the potential of using the proposed device for cells enhancing and healing using trapped composite gold-tourmaline atoms is also proposed and discussed. The advantages are the gold and tourmaline properties that can give more benefits for medical diagnosis and therapy, for instance, the electrical, magnetic and infrared properties, which can be useful for medical diagnosis and therapy. The use of proposed device for gold nano-particle with/without tourmaline material and safety issue is discussed.

2. The Model

To explain the technique of nano-particle trapping using optical technique, the optical trapping tool generation using laser propagation in a micro-optical device with suitable wavelength is recommended. Particle (WGMs) of light within the microring resonator can be generated by light propagation within a modified add-drop optical filter, from which the WGM outputs can be detected at each center ring within system in either in or out of the device surface, which have shown the advantage for atom trapping applications. Moreover, the leaky modes of light can also be used to form the optical tweezers for high density drug delivery usage, which has been the promising technique of drug trapping and delivery in this decade, more description can be found in references [28-31]. Principally, the basic tool of drug trapping is the optical tweezer that can be formed by light pulse, where in this work it can be generated by using the device in Figure 1(a), where the required output is the WGM probe that can be generated and described by the following equations.

$$E_{in} = E_0 \exp\left[\left(\frac{z}{2L_D}\right) - j\omega t\right] \tag{1}$$

$$E_1 = j\left(\frac{AE_{i1} + BE_{i2}}{CD}\right) \tag{2}$$

$$E_2 = \left(\frac{x_2 y_2 - x_2^2 y_2^2 P_R - x_2^2 z_2^2 P_R}{1 - x_2 y_2 P_R}\right) E_1 \tag{3}$$

$$E_4 = \left(\frac{x_4 y_4 - x_4^2 y_4^2 P_L - x_4^2 z_4^2 P_L}{1 - x_4 y_4 P_L}\right) E_3 \tag{4}$$

$$E_3 = \left[\frac{\left(x_2 x_3 y_2 y_3 P_{L4} - x_2^2 x_3 y_2^2 y_3 P_{L4} P_R - x_2^2 x_3 y_3 z_2^2 P_{L4} P_R\right) E_1 + j\left(x_3 z_3 P_{L8} - x_2 x_3 y_2 z_3 P_{L8} P_R\right) E_{i2}}{1 - x_2 y_2 P_R}\right] \tag{5}$$

where

$$A = x_1 z_1 P_{L8} - x_1 x_2 y_2 z_1 P_{L8} P_R - x_1 x_4 y_4 z_1 P_{L8} P_L + x_1 x_2 x_4 y_2 y_4 z_1 P_{L8} P_R P_L$$

$$B = x_1 x_3 x_4 y_1 y_4 z_3 P_{L4} P_{L8} - x_1 x_2 x_3 x_4 y_1 y_2 y_4 z_3 P_{L4} P_{L8} P_R - x_1 x_3 x_4^2 y_1 y_4^2 z_3 P_{L4} P_{L8} P_L + x_1 x_2 x_3 x_4^2 y_1 y_2 y_4^2 z_3 P_{L4} P_{L8} P_R P_L$$
$$- x_1 x_3 x_4^2 y_1 z_3 z_4^2 P_{L4} P_{L8} P_L + x_1 x_2 x_3 x_4^2 y_1 y_2 z_3 z_4^2 P_{L4} P_{L8} P_R P_L$$

$$C = x_1 x_2 x_3 x_4 y_1 y_2 y_3 y_4 P_{L4}^2 - x_1 x_2^2 x_3 x_4 y_1 y_2^2 y_3 y_4 P_{L4}^2 P_R - x_1 x_2^2 x_3 x_4 y_1 y_3 y_4 z_2^2 P_{L4}^2 P_R - x_1 x_2 x_3 x_4^2 y_1 y_2 y_3 y_4^2 P_{L4}^2 P_L$$
$$+ x_1 x_2^2 x_3 x_4^2 y_1 y_2^2 y_3 y_4^2 P_{L4}^2 P_R P_L + x_1 x_2^2 x_3 x_4^2 y_1 y_3 y_4^2 z_2^2 P_{L4}^2 P_R P_L - x_1 x_2 x_3 x_4^2 y_1 y_2 y_3 z_4^2 P_{L4}^2 P_L$$
$$+ x_1 x_2^2 x_3 x_4^2 y_1 y_2^2 y_3 z_4^2 P_{L4}^2 P_R P_L + x_1 x_2^2 x_3 x_4^2 y_1 y_3 z_2^2 z_4^2 P_{L4}^2 P_R P_L$$

$$D = 1 - x_2 y_2 P_R - x_4 y_4 P_L + x_2 x_4 y_2 y_4 P_R P_L$$

$x_i = \sqrt{1-\gamma_i}$, $y_i = \sqrt{1-\kappa_i}$ and $z_i = \sqrt{\kappa_i}$, where $i = 1, 2, 3$ and 4

$$P_R = \exp\left(-\frac{\alpha}{2}L_R - jk_nL_R\right),\ P_L = \exp\left(-\frac{\alpha}{2}L_L - jk_nL_L\right)$$

where $L_R = 2\pi R_R$, $L_L = 2\pi R_L$ and $k_n = \frac{2\pi}{\lambda}$

$$P_{Li} = \exp\left(-\frac{\alpha}{i}L_D - 2jk_n\frac{L_D}{i}\right)$$

From Figure 1, the input fields propagate within the PANDA ring are substituted by a group of equations, where E_1, E_2, E_3 and E_4 are the electric fields, $\gamma_1, \gamma_2, \gamma_3$ and γ_4 are the fractional coupling losses, $\kappa_1, \kappa_2, \kappa_3$ and κ_4 are the coupling coefficients, α is an attenuation coefficient, $k_n = \frac{2\pi}{\lambda}$ is the wave propagation number in vacuum, $L = 2\pi R$ is the center ring propagation distance, $L_{R\,or\,L} = 2\pi R_{R\,or\,L}$ is the nanoring propagation distance, where R and L denote as right and left nanoring radii, $j = \sqrt{-1}$ is the imaginary part of complex number. The nonlinear refractive index (n) of the substances in the system is defined by

$$n = n_0 + n_2 I = n_0 + n_2\left(\frac{P}{A_{eff}}\right) \tag{6}$$

Where n_0, n_2 are the linear and nonlinear refractive indices, where I and P are the optical intensity and optical power, respectively. Where A_{eff} is the effective mode core area [32], which is ranged between 0.10 μm^2 and 0.50 μm^2. From equations (2)-(5), the rearrangement of WGM in the Equation (2) is used to obtain the whispering gallery mode output.

This proposed device and system are designed and simulated by using the practical parameter values, which means that the realistic fabrication and test can be produced. However, the cost of fabrication of a prototype is very high, therefore, this proposed work can be done and achieved by simulation and manipulation which is based on practical device parameter values. By using Equations (1)-(5), the main parameters are given by the above details (insets). The whispering gallery mode (trapping probe) of the PANDA ring is obtained by using Equation (5), which can be used as an optical tweezer (optical probe), where the tweezer witching up or down can be controlled for atom injecting and removing usages. In application, the certain skin layer penetration dept and target cells can be designed by the suitable trapping force and atom size, where the required switching wavelength and power can be given to work with harmless to the target cells environments. However, this is a low injection power and electrical current that cannot be harm to the good cells. Alternatively, cells can be excited by the infrared light, where the required heat (energy) level can be controlled and used for cells enhancement and therapy. Moreover, the use of nano-particle composites, for instance, gold-tourmaline composite particles, especially, the black tourmaline as previous mentioned can be plausible for aura diagnostics and therapy. The trapping and switching model is as shown in Figure 1(b) and 1(c), which will be described in the following section.

3. Simulation

Currently, all forms of light travelling within a Panda ring resonator can be described in various forms, for instance (i) wave propagation by ray tracing, (ii) particle aspect by Schrodinger equation and (iii) the leaky modes and whispering gallery modes (WGMs) [33]. In Figure 1, light from a semiconductor laser source with power 0.5 W is input into the PANDA ring input port then it circulates within the device. The whispering gallery modes of light within the device can be generated by controlling the suitable conditions (parameters), where finally the required optical trapping probes in the forms of surface plasmon pulses can be obtained. The other device parameters are chosen and simulated for wider investigations. In Fig. 1(c), the optical switching of WGM probes can be formed and controlled via the add port input signals, where the superposition of signals can be arranged to obtain the required switching probes and directions. In the experimental simulation, the used system is as shown in Figure 2, where the model of nano-particle trapping and storage panel is schematically detailed. The array of Panda ring device can be produced for large scale trapping probes, where the large scale treatments can be realized. The simulation programs are the commercial MATLAB and Opti-wave software. All parameters are chosen based on the practical device parameters. The input wavelength source into the system is 1.55 μm, which is input into the input port of the AlGaAs/InP ring material. The center ring radius is 2.0 μm, the right and left ring radii are 1.05 μm, the coupling constants(κ) are $\kappa_1 = \kappa_2 = \kappa_3 = \kappa_4 = 0.5$, the linear and nonlinear refractive indices are $n_0 = 3.9476$ and $n_2 = 1.7 \times 10^{-13}$ cm^2W^{-1}, respectively [32], the waveguide loss(α) is 0.1 dBm-1 and $\gamma = 0.01$. In Figure 2(b), the red color outputs are the WGM outputs that direct outward(switching up) from of the device surface, where the blue color ones are the outputs that direct inward(switching down) into the device, which can be used to form the required switching directions and used for injecting and removing atoms. The composite atoms can be stored within the panel, where the injecting and removing atoms can be applied by using the switching control via the add port input control. The nano-particle trapping panel (thin film) is as shown

in Figure 2, where the tissue buffer is needed the specific design to protect the unwanted tissue treatments. Typically, a single device can be a centimeter scale dimension. However, the panel dimension can be ranged from 1 centimeter to 10 centimeter because the large area device is needed for more area of applications. In the simulation, it was found that the WGMs and leaky modes of light within the Panda ring can be generated and controlled by using the appropriated simulation parameters, which means that the use for practical may be plausible and realized. More details will be given in the following section.

4. Technical Concept

In this proposal, we believe that the drug targeting of the composite gold-tourmaline atom can be performed based on the following reasons, (i) gold particle trapping is well established, (ii) particle trapping technique is experimentally confirmed, (iii) the reasonable trapping force is confirmed, and (iv) the natural tourmaline is existed. Regarding to the previous section, the required leaky or WGM modes can be controlled to form the required tweezer switching (up or down switching) probes, where the trapped composite gold tourmaline atoms can be obtained. In operation, the trapped atoms can be deposited (injected) into the required positions. By using the proposed panel, the composite gold tourmaline atoms can be trapped, stored within the panel before the cosmetics treatment being used, which can be suitable for both flat and rough surfaces, which is shown in Fig. 3(a). In addition, the removed gold atoms can be operated from the embedded positions by the oposit switching direction, from which the gold atoms can be extracted from the tourmaline mixture.

The use of this technique can be categorized into two forms, where firstly, the injection method, secondly, the removal method, where both methods are commonly needed the safety operation. The trapping force is consisted of gradient force (F_{Grad}), scattering force (F_{Scatt}), friction force (F_{Fric}) and viscosity force (F_{Vis}) as shown in Figure 3(a) [34], where the scattering force is generated by the conservation of momentum, the gradient force is the generated by light pulse potential energy in the form of Gaussian pulse, where the last two forces are the friction forces generated by the fluid content and surface roughness. V(t) is the trapped atom velocity that is in the resultant force direction. The combination of those four vector forces is the resultant force, which is normally within the range of pico to nano Newton [35-37], which is large enough to trap the nano-scale particle, for instance, gold, silver or bio-cells. In this proposed device, the required atoms can be trapped and dragged by the WGM probe. The atom injection into the deep skin layer is as shown in Figure 3(c), where the combination of forces is the key role of this phenomenon. The trapping and switching atom concepts are as shown in Figure 1(a) and 1 (b). Number of trapped atoms can be increased by the increasing in tweezer width and power, which means that the resultant force is increased due to the increasing in optical power, where finally, well depth and width of the trapping probe can be designed and suitable used, however, the safety issue is needed to be taken care.

5. Applications

5.1 Cosmetics Treatments

A thin film array panel using multi-optical trapping probe system is designed and modeled using the well established commercial software (Opti-wave), where the practical device material, scale and parameters are manipulated and results shown. Gold nano-particles have been the promising potential elements of using for therapeutic and cells enhancements, especially, for cancerous cells treatment and cosmetics. The use of gold nano-particle is combined with the other minerals such as gemstones have become the interesting aspect of applications. Regarding to the nano-scale technology regime, the combination between gemstones and gold (silver) nano-particles can be formed, where the composite gold nano-particles by gemstones can keep the dimension of them being in the nano-scale range, which can be used similarly to the original drug delivery concept ones. However, the new mechanism, treatment method and safety issue are become the important things for investigations.

Tourmaline is recognized as the innert material though the complex mineral in nature, which has the electical, i.e. piezoelectric property, which is suiatble for cosmetics applications due to the infrared light dsitribution property [38]. Furthermore, there is no published research showing tourmaline has any proven effect on skin whatsoever, especially, for surface treatment. Tourmaline can generate an electrical charge when it is in the pressure environment, from which it can be used for pressure sensors(pressure gauges). Tourmaline also has the pyroelectric property, where the electrical charge is changed during a temperature change. Although, this is the modeling paper based on the previous system design and results, in which the use of composite gold tourmaline in the proposed model can be done similarly to the pure Au and Ag particle usages, where the gold and tourmaline properties can provide more benefits in electrical, magnetic and thermal properties, which can give benefits for the applications such as cancer cells killer and acne treatments [39], while the magnetic property of particle has also been used in the magnetic sensors and therapy using the nano-scale device [40, 41]. In addition, the far infrared treatment using the tourmaline, especially, the black tourmaline has shown the promising application, especially, the aura therapy.

5.2 Cells Enhancing

Cells enhancing in this work is concentrated on the facial cells treatment, which can be enhanced by using the composite gold tourmaline atom properties, where the successful applications have been realized by the surface treatments in cosmetics use. Regarding to this proposal, the trapping technology, the shallow skin layer treatment using the composite gold tourmaline is proposed and may be possible. In Fig. 1, the optical trapping probes are generated using the nonlinear microring resonator known as a PANDA ring resonator, which can be used to trap and transported atoms into the skin layers.

The used material is AlGaAs/InP that can be used to form the trapped atom/molecule storage system, in which the net trapping force is produced by the gradient and scattering force of the trapping probe that generated by the optical tweezer in the scale of pico(nano) scale force [36-38]. The WGM output wavelength is ranged within the infrared spectrum region, which is claimed as the harmless light power to the trapping atom and environmental cells [26, 42]. The atom delivery (injection) and removal to/from the target atoms can be operated by using the WGM switching control. The large area of trapping probes can also be formed and used as an injection, storage and removal tools for deep skin or surface treatment usages. After trapping, the designed particles can be injected, removed, excited, embedded, enhanced and releasing within the target cells positions. The required cells treatment and enhancement can be provided and realized. Safety issue of using such content for facial surface treatment is very important and needed to be clarified in this works, where apparently, the use of purely gold nano-particle and no evidence of toxic generation in any form. The safety issue of such a proposed scheme, especially, the nano-particle and gemstone toxics will be discussed in the next section.

The form of resultant force is generated by a surface plasmon pulse in either peak or valley forms. The traveling distance of force can be desired and improved. In practice, the aura shading area and wavelength can be seen by using the specific detector (camera), in which the specified filter is required to detect the far infrared wavelength output, which is ranged between 6-14 μm [26, 38]. The aura shading area can be used in medical diagnosis and investigation, where the specific analysis and therapy can be assigned. For instance, the use of medical diagnostics for some specific cases, where the penetration depth of the delivery atom can be controlled to reach the designed embedded location (position) [35], where the shallow skin layer between 100-200 μm could be possible. While the removal of atom can also be done by using the similar technique but in this case the embedded atoms are trapped and removed from the desired positions by using the trapping probe switching control. However, the penetration depth range can be improved by the suitable WGM power and width, which will be the key issue of the interesting research and investigation. By using this proposed panel, the embedded and removed atoms can be desired, thus, the embedded duration time can be considered for security usage [43, 44]. For instance, the use of composite gold-tourmaline can be realized for shallow skin layer cosmetics, where in addition, the use of aura diagnostics and therapy can also be plausible [26, 27]. The use of such proposed device panel for other applications such as magnetic net and therapy, cells enhancements and cancerous cells treatments are also available.

6. Conclusion

We have shown that the drug delivery method incorporating the THz technology can be applied for cosmetics treatments and medical applications, where in addition the THz wavelength output is not harmed to cells and the surrounded environment. We have also proposed that the technique of facial cells treatment and enhancement using in either pure gold or composite gold-tourmaline is very interesting, where the benefit of far infrared, positive ion and magnetic property of the composite gold-tourmaline have become the challenged potential benefits. Generally, the other gemstones can also be applied by the same technique but the safety issue is needed to be clarified and tested before being realized and used. The advantages of the proposed technique are used to (i) trap, store and remove composite gold-tourmaline atoms, (ii) trap gold atoms and mix with tourmaline before injection(delivery), apply for cells enhancing and healing usages, and (iii) extract gold atoms from tourmaline. By using this technique, the trapping probe was firstly generated by using the well-known optical technique and software, where the nano-scale force of optical probe could be generated and used to trap the required gold particles, which can be mixed to tourmaline and injected closely to the target cells, where in this case the penetration depth of injection atom can be controlled by light source powering and focusing probes. Alternatively, the opposite switching of trapping tool could be controlled and used for atom removal requirements. The advantage of this device is that atoms can be trapped, injected to the certain dept and removed from the deposited position without any harm to the surrounded cells, i.e. a nondestructive (NDT) method. The benefit of far infrared treatment concept using tourmaline property is also available, which can be treated as the aura diagnosis and therapy.

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Disclosure

There is no conflict of interests regarding the publication of this article.

References

[1] P.P. Yupapin and W. Suwancharoen, Chaotic Signal Generation and Cancellation using a Micro Ring Resonator Incorporating an Optical Add/drop Multiplexer, Optics Commun., 272(1), 81-86, 2007.

[2] S. Chiangga, S. Pitakwongsaporn, T.D. Frank, P.P. Yupapin, Optical Bistability Investigation in a Nonlinear Silicon Microring Circuit, IEEE Lightwave Technology, 31(7), 1101-1105, 2013.

[3] A. Shen, C. Qiu, L. Yang, T. Dai, Y. Li, H. Yu, Y. Hao, X. Jiang, J. Yang, Tunable Microring Based On-Chip Interrogator for Wavelength-Modulated Optical Sensors, Optics Commun., 340, 116-120, 2015.

[4] J. Xie, L Zhou, X. Li, J. Chen, Microdisk Resonator Assisted All-optical Switching with Improved Speed using a Reverse-BiasedP-N Diode, Optics Commun., 343, 51-55, 2015.

[5] I. Teraoka, A Hybrid Filter of Bragg Grating and Ring Resonator, Optics Commun., 339, 108-114, 2015.

[6] H. Cai and A.W Poon, Optical Manipulation of Microparticles using Whispering-Gallery Modes in a Silicon Nitride Microdisk Resonator, Optics Letters 36, 4257-4259, 2011.

[7] H. Cai and A.W. Poon, "Optical Manipulation and Transport of Microparticles on Silicon Nitride Microring Resonator based Add-drop Devices," Optics Letters 35, 2855-2857, 2010.

[8] H. Cai and A.W Poon, "Optical Trapping of Microparticles using Silicon Nitride Waveguide Junctions and Tapered-waveguide Junctions on an Optofluidic Chip," Lab on a Chip 12, 3803-3809, 2012.

[9] H. Cai and A.W. Poon, "Planar Optical Tweezers using Tapered-waveguide Junctions, Optics Letters, 37, 3000-3002, 2012.

[10] N. Suwanpayak, M.A. Jalil, C. Teeka, J. Ali and P.P. Yupapin, Optical Vortices Generated by a PANDA Ring Resonator for Drug Trapping and Delivery Applications Biomedical Optics Express, 2(1), 159-168, 2011.

[9] M. Bahadoran, J. Ali and P.P. Yupapin, Ultrafast Switching using Signal Flow Graph for Panda Resonator, Applied Optics, 52(13) 2866-2873, 2513.

[10] I. Srithanachai, S. Ueammanapong, S. Niumcharoen, P.P. Yupapin, Novel Design of Solar Cells Efficiency Improvement using an Embedded Electron Accelerator on Chip, Optics Express, 20(12), 12640-12648, 2012.

[11] I.S. Amiri, S.E. Alavi, S.M. Idrus, A.S.M. Supa'at, J. Ali and P.P. Yupapin, W-Band OFDM Transmission for Radio-Over-Fiber Link Using Solitonic Millimeter Wave Generated by MRR, IEEE Quantum Electronics, 50(8), 622-628, 2014.

[12] I.S. Amiri, S.E Alavi, S.M. Idrus, A. Nikoukar, J. Ali, IEEE 802.15.3c WPAN Standard Using Millimeter Optical Soliton Pulse generated by a Panda Ring Resonator, IEEE Photonics Journal, 5(5), Article # 7901912, 2013.

[13] S.E. Alavi, I.S. Amiri, S.M. Idrus, A.S.M. Supa'at, Generation and Wiree/Wireless Transmission of IEEE802.16m Signal using Solitons generated by Microring Resonator, Optical and Quantum Electronics, 2014, doi: 10.1007/s11082-014-9955-26.

[14] I.S. Amiri, M.R.K. Soltanian, S.E. Alavi and H. Ahmad, Optical and Quantum Electronics, 2015: doi: 10.1007/s11082-015-0125-2.

[15] S.E. Alavi, I.S. Amiri, S.M. Idrus, A.S.M. Supa'at, J. Ali and P.P. Yupapin, All-Optical OFDM Generation for IEEE802.11a Based on Soliton Carriers Using Microring Resonators, IEEE Photonics Journal, 6(1), 7900109, 2014.

[16] T. Saktioto, D. Irawan, P.P. Yupapin and P. Phataracorn, Graphene dual Properties, Mobility and Polarisibility: The Challenge, J Biosensors and Bioelectronics, 5(3), 1000e130, 2014.

[17] M.S. Aziz, N. Suwanpayak, M.A. Jalil, R. Jomtarak, T. Saktioto, J. Ali and P.P. Yupapin, Gold Nanoparticle Trapping and Delivery for Therapeutic Applications, International Journal of Nanomedicine, 7: 11-17, 2012.

[18] C.Y. Wu, C. Yu and M.Q. Chu, A Gold Nanoshell with a Silica Inner Shell Synthesized using Lipsome Templates for Doxorubicin Loading and Near-infrared Photothermal Therapy, International Journal of Nanomedicine, 6, 807-813, 2011.

[19] A.J. Mieszawska, W.J.M Mulder, Z.A. Fayad, D.P. Cormode, Multifunctional Gold Nanoparticles for Diagnosis and Therapy of Disease, Molecular Pharmaceutics, Mol Pharm. 2013 Mar 4;10(3):831-47.

[20] K. Anderson, Assessing use of gold nanoparticles, Cosmetics & Toiletries, June 1, 2013.

[21] C. Eason, The New Crystal Bible, London, Carlton Books Ltd., 2010.

[22] M. Gienger, Healing Crystals, Scotland, Earthdancer Books, 2009.

[23] R. Simmons and N Assian, The Book of Stones, Berkley, CA, North Atlantic Books, 2007.

[24] W. Schumann, Gemstones of the World, 3rd edition, Sterling Publishing, New York, 2006.

[25] N. Li, P. Zhao and D. Astruc, Anisotropic Gold Nanoparticles: Synthesis, Properties, Applications, and Toxicity, Angew. Chem. Int. Ed. 2014, 53, 1756 – 1789..

[26] S. Suwandee and P.P. Yupapin, Gold Nano-particles Separation and Storage for Cosmetics, Healthcare and Beauty with Safety Usage, Life, 11(10), 1225-1229, 2014.

[27] S. Suwandee and P.P. Yupapin, Gemstone Property Studies for Minerals Based Cosmetics and Beauty Applications, Life Sci J., 11(1), 871-873, 2014.

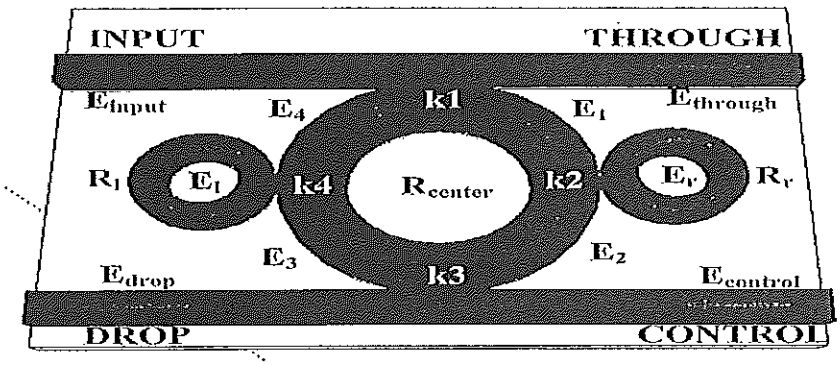
[28] R. Simmons and N. Ahsian, The Book of Stones, Berkley, CA, North Atlantic Books, 2007.

[29] A. Vainshelboim, K.S. Monoh, Bioelectrographic Testing of Mineral Samples: A Comparison of Techniques, J Altern Complement Med., 11(2), 299-304, 2005.

[30] A. Ashkin, J. M. Dziedzic & T. Yamane, Optical Trapping and Manipulation of Single Cells using Infrared Laser Beam,

Nature, 330 : 769-771, 1987.
[31] A. Ashkin, Karin Schütze, J. M. Dziedzic, Ursula Euteneuer and Manfred Schliwa, Force Generation of Organelle Transport Measured in Vivo by an Infrared Laser Trap, Nature, 348 : 346-348, 1990.
[32] C. Teeka, M.A. Jalil, J. Ali and P.P. Yupapin, Novel Tunable Dynamic Tweezers using Dark-bright Soliton Collision Control in an Optical Add-drop Filter, IEEE Transaction on Nanobioscience, 9(4) : 258-262, 2010.
[33] P. P. Yupapin, WGMs on-Chip Design for Interdisciplinary Studies, Science Journal of Education, Science Journal of Education, 1(1), 1-5, 2013.
[34] R. Siriroj, N. Thammawongsa and P.P. Yupapin, Micro Energy Source using WGMs of Wave in a Small Optical Device, Energy Procedia, 34, 1-8, 2013.
[35] J. Bergeron, A.Z. Oskuie, S. Ghaffari, Y. Pang, R. Gordon, Optical Trapping of nanoparticles, J Vis Exp., 15(71) e4424, 2013.
[36] B. Hester, G.K. Campbell, C.L. Mariscal, C.L. Filgueira, R. Huschka, N.J. Halas, K. Helmerson, Tunable Optical Tweezers for Wavelength-dependent measurements, Rev. Sci. Instrum. 83(4), 043114, 2012.
[37] K.A. Brown, R.M. Vestervelt, Proposed Triaxial Atomic Force Microscope Contact-Free Tweezers for Nanoassembly, Nanotechnology, 20(38), 385302, 2009.
[38] G. Xue, C. Han, J. Liang, S. Wang, C. Zhao, Preparation of tourmaline nano-particles through a hydrothermal process and its infrared emission properties, J. nanoscience and nanotechnology, 14(5) 3943-3947, 2014.
[39] M. Guix, C. Carbonell, J. Comenge, L.G. Fernandez, A. Alarcon, E. Casals, Nanoparticle for Cosmetics, How Safe is Safe ?, Contribution to Science, 4(2), 213-217, 2008.
[40] C.Y. Wu, C. Yu and M.Q. Chu, A Gold Nanoshell with a Silica Inner Shell Synthesized using Lipsome Templates for Doxorubicin Loading and Near-infrared Photothermal Therapy, International Journal of Nanomedicine, 6, 807-813, 2011.
[41] N. Thammawongsa, S. Mitatha and P.P. Yupapin, Optical Spins and Nano-antenna Array for Magnetic Therapy, IEEE Transaction on nano-bioscience, 12(3), 228-232, 2013.
[42] P.P. Yupapin, Optical Spins Generated by a Modified Add-drop Filter for Network Sensors, Comprehensive Materials Processing, 13, 307-315, 2014.
[43] P.P. Yupapin and J. Vesessamit, Optical Capsule: A Secure Micro-molecular Transporter, Nanoscience Letters, 4(3), 36-41, 2014.
[44] M.A. Jalil, N. Suwanpayak, K. Kulsirirat, S. Suttirak, J. Ali and P.P. Yupapin, Embedded Nanomicro Syringe on Chip for Molecular Therapy, International Journal of Nanomedicine, 6: 2925-2932, 2011.

Figures:



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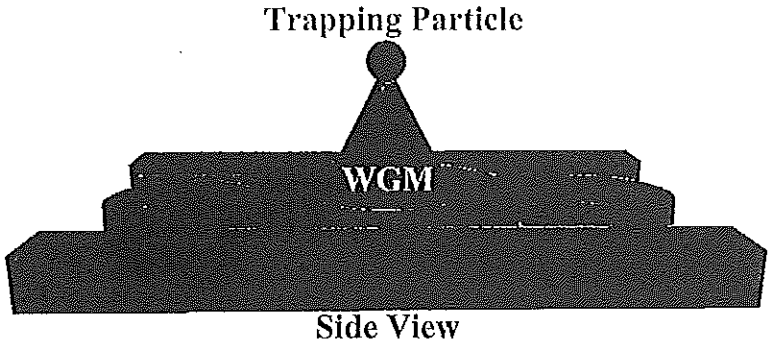

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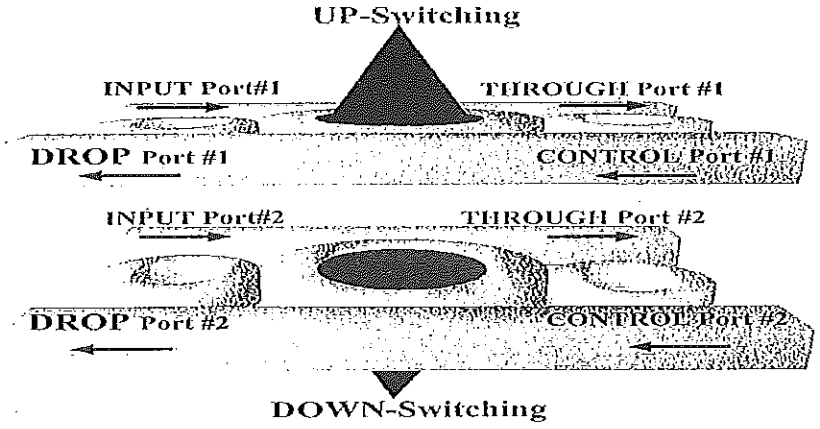
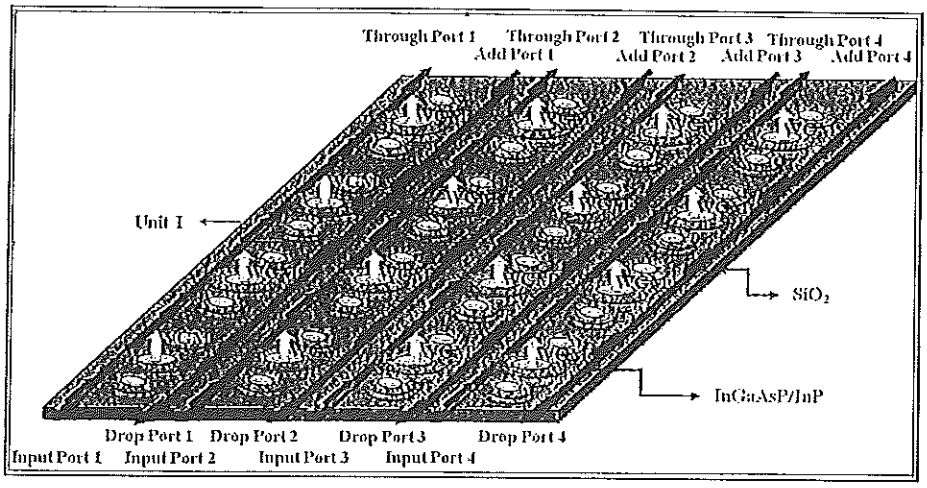
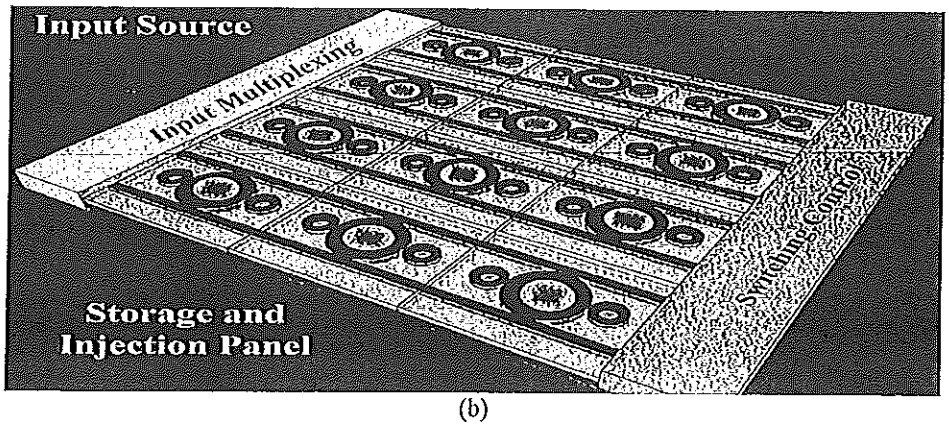


(c)

Figure 1: A schematic of nano-particle trapping and injection device, where (a) a PANDA ring resonator, (b) trapped particle by WGM probe, (c) tweezer switching direction model

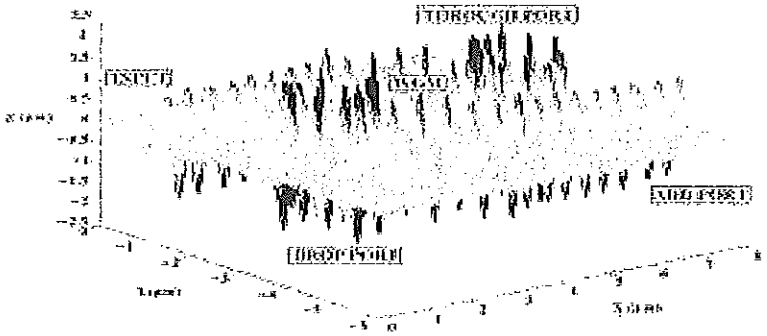


(a)



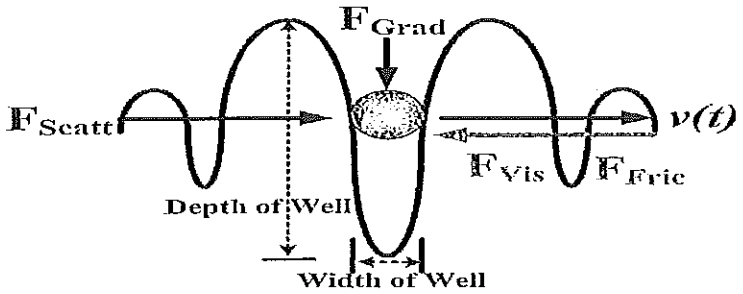
(b)

Figure 2: Model of nano-particle trapping and storage with a tissue buffer, where (a) device array schematic model, (b) device panel model

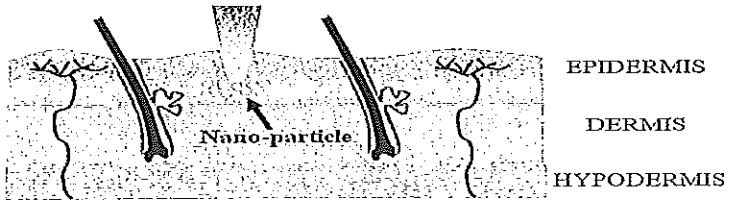


(a)

Figure 2: Potential wells and tweezers generated by light pulse surface plasmon []



(a)



(b)

Figure 3: Atom trapping and injecting structures, where (a) optical probes, (b) the trapping tool and width model, (c) the embedded atoms into the skin layer