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Correlation of Optical Properties of Waveguide in Nano Scale

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Abstract: Optical properties are measured in wave guides in both Air medium 50 nm to 1000 nm and water medium 50 nm to 1000 nm and correlated between micro scale and Nano scale. Wave length is measured between 50 nm to 1000 nm and observed symmetry between core thickness in micro scale, cladding refractive index and layer thickness in nano scale.

Keywords: Wave length, Core thickness, cladding thickness, layer thickness, micro scale and nano scale ranges, air medium and water medium.

I. Introduction

The makes use of of waveguides for transmitting indicators have been recognized even before the term was once coined. The phenomenon of sound waves guided through a taut wire have been known for a lengthy time, as properly as sound via a hole pipe such as a cave or clinical stethoscope. Other makes use of of waveguides are in transmitting electricity between the components of a machine such as radio, radar or optical devices. Waveguides are the quintessential precept of guided wave testing (GWT), one of the many strategies of non-destructive evaluation. Specific examples: Optical fibers transmit light and signals for long distances with low attenuation and a large usable vary of wavelengths. In a microwave oven a waveguide transfers power from the magnetron, where waves are formed, to the cooking chamber. In a radar, a waveguide transfers radio frequency energy to and from the antenna, the place the impedance needs to be matched for efficient electricity transmission. Rectangular and Circular waveguides are usually used to connect feeds of parabolic dishes to their electronics, either low-noise receivers or power amplifier/transmitters. Waveguides are used in scientific gadgets to measure optical, acoustic and elastic homes of substances and objects. The waveguide can be put in contact with the specimen, in which case the waveguide ensures that the electricity of the checking out wave is conserved, or the specimen may also be put inner the waveguide (as in a dielectric regular measurement[3]), so that smaller objects can be tested and the accuracy is better. Transmission traces are a unique type of waveguide, very regularly used.

II. Methodology

Waveguides used at optical frequencies are normally dielectric waveguides, constructions in which a dielectric material with excessive permittivity, and for that reason excessive index of refraction, is surrounded by means of a fabric with decrease permittivity. The structure guides optical waves by means of whole internal reflection. An instance of an optical waveguide is optical fiber.

Other sorts of optical waveguide are additionally used, together with photonic-crystal fiber, which guides waves through any of countless wonderful mechanisms. Guides in the structure of a hole tube with a tremendously reflective inner floor have additionally been used as light pipes for illumination applications. The inner surfaces may additionally be polished metal, or may additionally be blanketed with a multilayer film that guides mild via Bragg reflection. One can additionally use small prisms around the pipe which mirror mild via complete internal reflection such confinement is always imperfect, however, seeing that whole inner reflection can never genuinely guide mild inside a lower-index core.

III. AIR MEDIUM

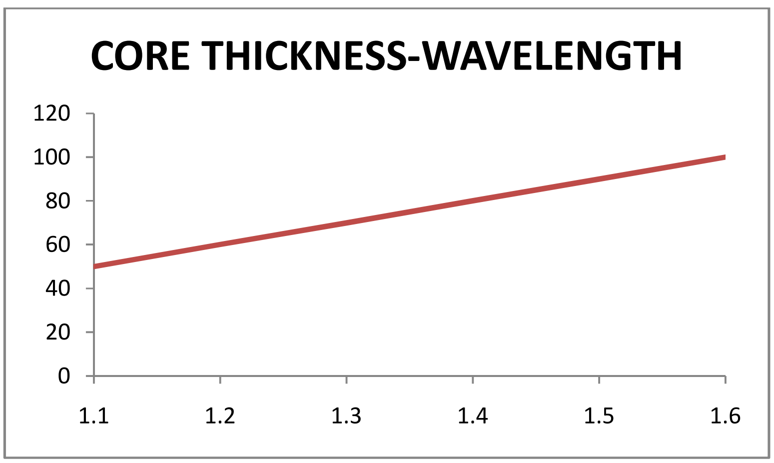
A) Wavelength Range

a) 50 nm-100nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
50	1.1	1.1	27.24
60	1.2	1.2	22.59
70	1.3	1.3	21.05
80	1.4	1.4	20.40
90	1.5	1.5	20.11
100	1.6	1.6	20.00

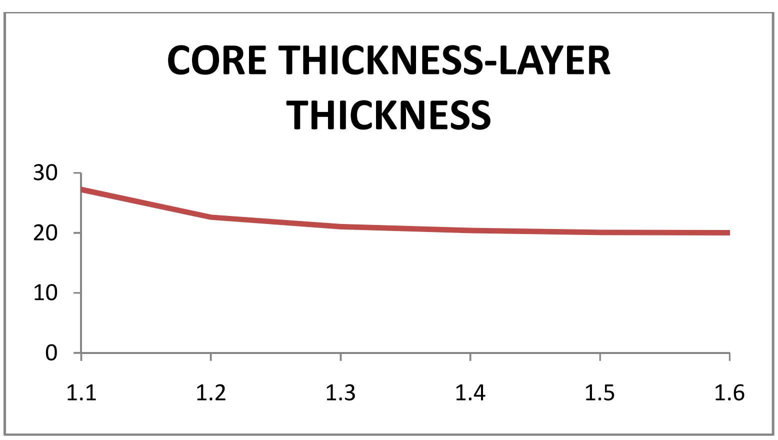
Table 1 explains about wave length (nm) from 50nm to 100nm range, core thickness from 1.1 µm to 1.6 µm, cladding refractive index 1.1 to 1.6 and layer thickness from 27.24 nm to 20.00 nm. 1.6 µm is highest core thickness at 100 nm wavelength. 1.6 is highest Refractive index at 100 nm wavelength. 27.24 nm is highest layer thickness at 50 nm wavelength.

Graph:-1



Graph-1 explains Wavelength increases linearly with Core Thickness.

Graph-2:



Graph-2 Explains Core Thickness and Layer Thickness varies with linear relationship between them

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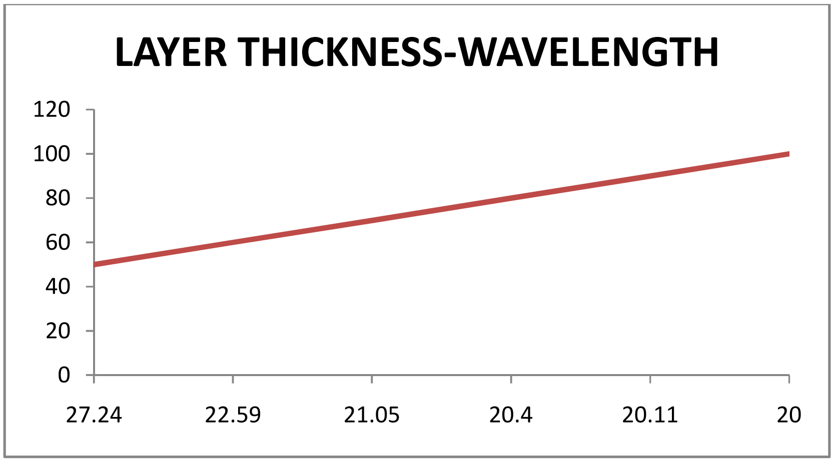
Graph:-3



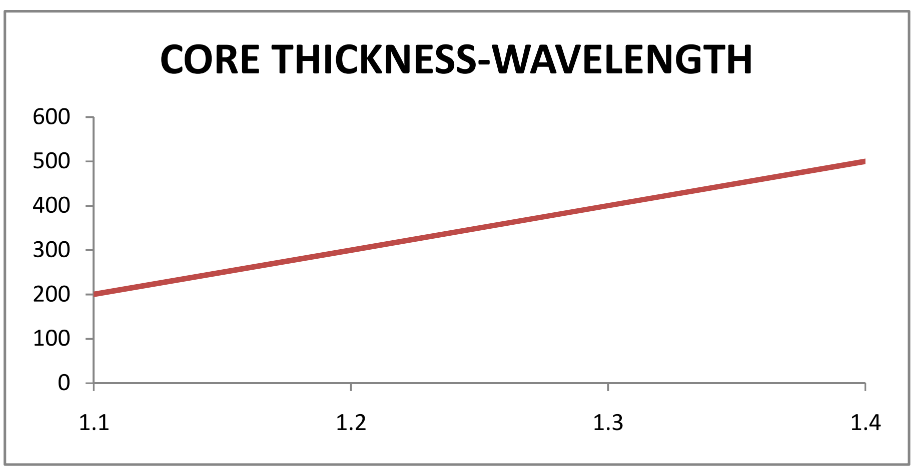
Graph-3 explains linear relationship between Layer Thickness and Wavelength.

B) WAVELENGTH RANGE: 200 Nm To 500 Nm

Wavelength Nm	Core thickness µm	Cladding Refractive index	Layer Thicknessnm
200	1.1	1.1	27.24
300	1.2	1.2	22.59
400	1.3	1.3	21.05
500	1.4	1.4	20.40

Table 2 explains about wave length (nm) from 200nm to 500nm range, core thickness from 1.1 µm to 1.4 µm, cladding refractive index from 1.1 to 1.4 and layer thickness from 27.24 nm to 20.40 nm. 1.4 µm is highest core thickness at 500 nm wavelength. 104 is highest cladding Refractive index at 500 nm wavelength. 27.24 nm is highest layer thickness t 200 nm wavelength.

Graph-4:



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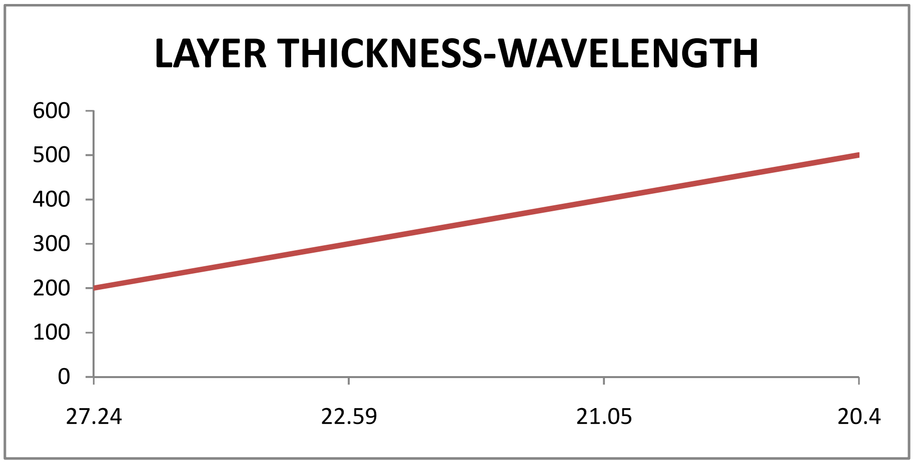
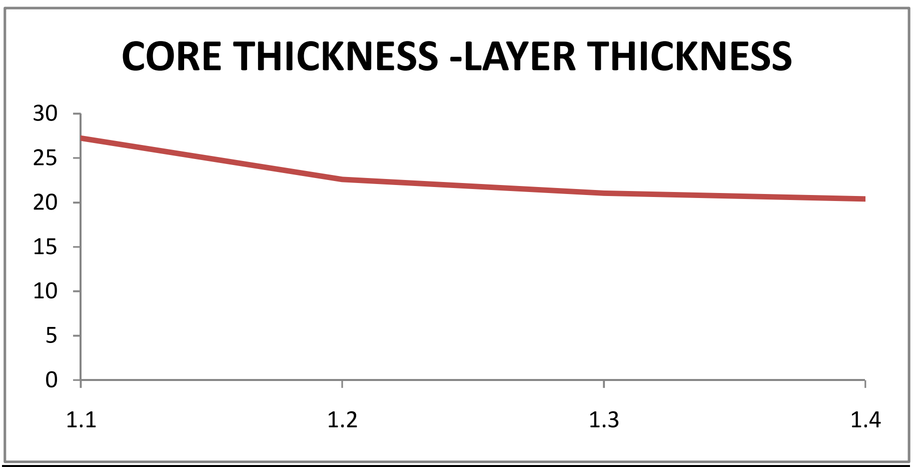
Graph-5:



Graph 5 explains linear relationship between Layer Thickness and Wavelength.

Graph-6:



Graph-6 Explains Linear Relationship between Core Thickness and Layer Thickness.

C) Wavelength Range: 600 NM TO 1000 NM

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
600	1.6	1.6	118.76
700	1.7	1.7	125.88
800	1.8	1.8	132.18
900	1.9	1.9	137.79
1000	2.0	2.0	142.85

Table 3 explains about wave length (nm) from 600 nm to 1000 nm range, core thickness from 1.6 µm to 2.0 µm, cladding refractive index from 1.6 to 2.0 and layer thickness from 118.76 nm to 142.85 nm. 2.0 µm is highest core thickness at 1000 nm wavelength. 2.0 is highest cladding refractive index at 1000 nm wavelength. 142.85 nm is highest layer thickness at 1000 nm wavelength

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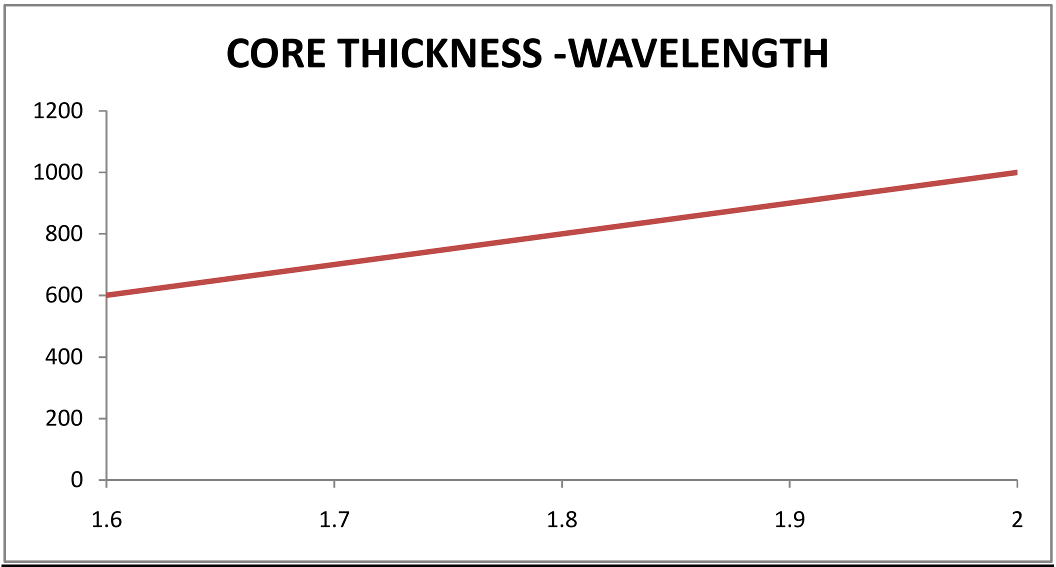
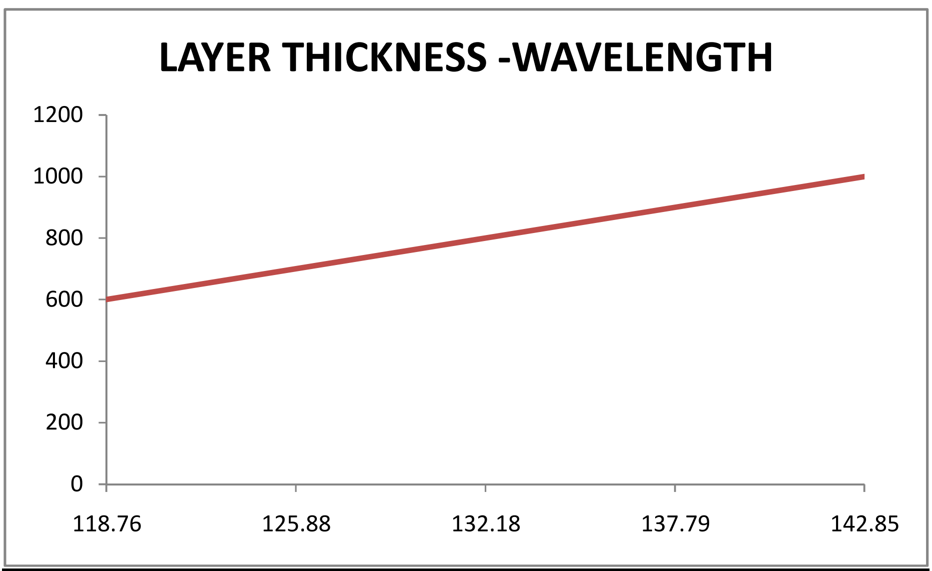
Graph-7:



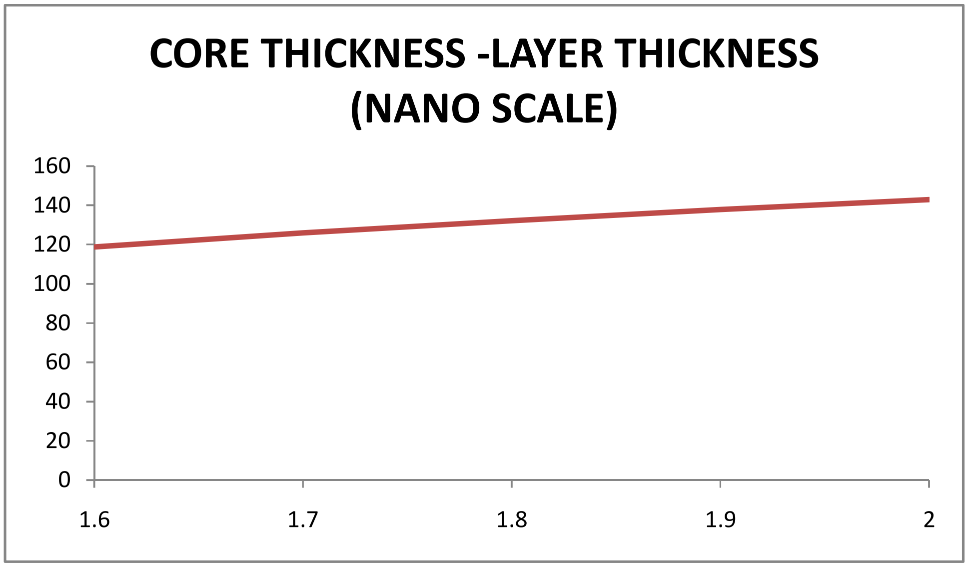
Graph-7 explains about linear relationship between Core Thickness and Wavelength.

Graph-8:



Graph-8 explains Linear relationship between Layer Thickness and Wavelength.

Graph-9



Graph-9 Explains Linear relationship between Core Thickness and Layer Thickness

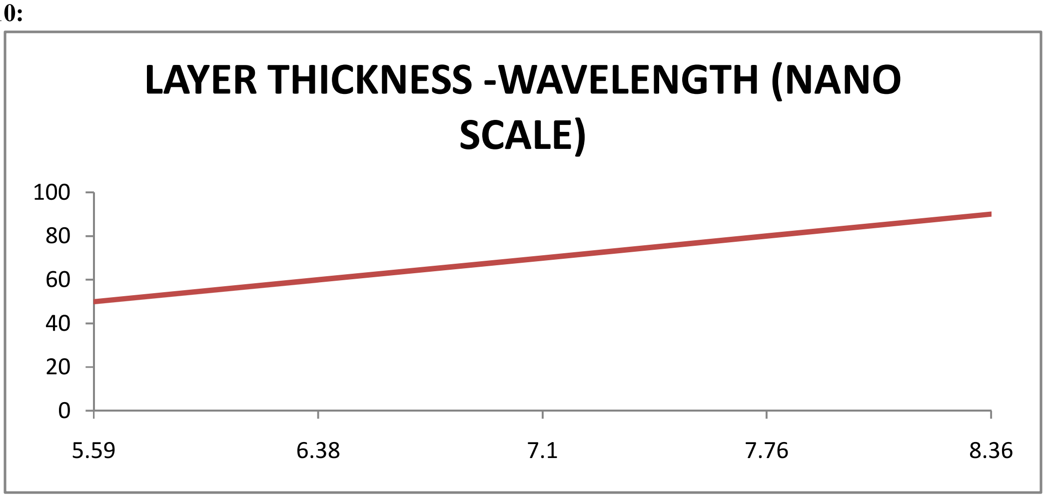
C) Water Medium

a) Wave Length Range: 50-90 Nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness Nm
50	1.1	2.6	5.59
60	1.2	2.7	6.38
70	1.3	2.8	7.10
80	1.4	2.9	7.76
90	1.5	3.0	8.36

Table 4 explains about wave length (nm) from 50 nm to 90 nm range, core thickness from 1.1 µm to 1.5 µm, cladding refractive index from 2.6 to 3.0 and layer thickness from 5.59 nm to 8.36 nm.

Graph-10:



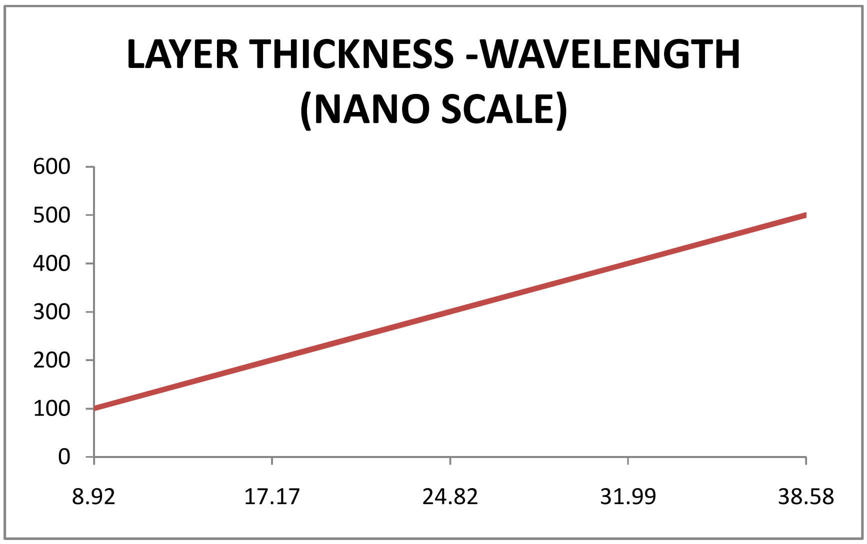
Graph-10 explains Linear Relationship between Layer Thickness and Wavelength in Nano Scale

b) Wavelength range: 100 nm to 500 nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
100	1.6	3.1	8.92
200	1.7	3.2	17.17
300	1.8	3.3	24.82
400	1.9	3.4	31.99
500	2.0	3.5	38.58

Table 5 explains about wave length (nm) from 100 nm to 500 nm range, core thickness from 1.6 µm to 2.0 µm, cladding refractive index from 3.1 to 3.5 and layer thickness from 8.92 nm to 38.58 nm.

Graph-11:



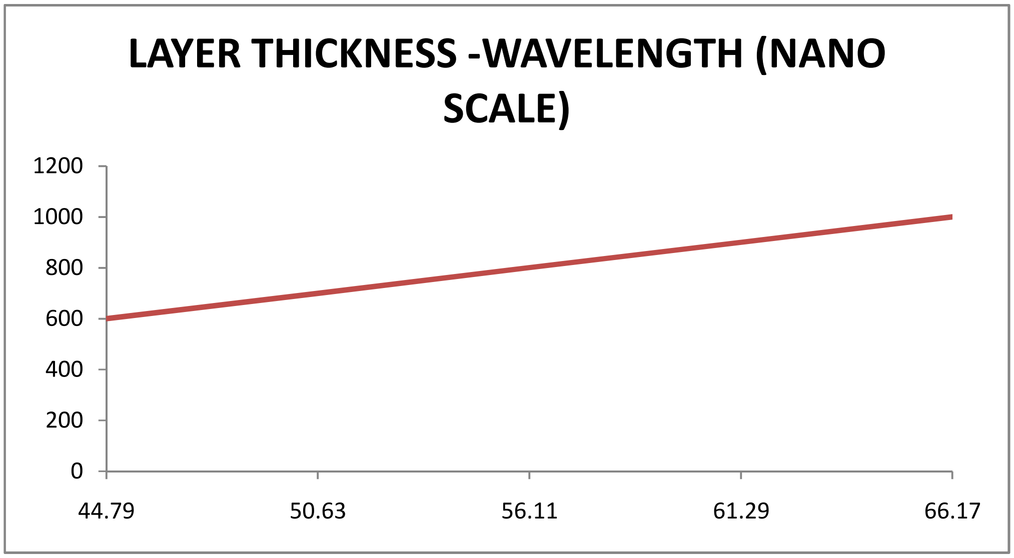
Graph-11 explains Linear Relationship between Layer Thickness and Wavelength in Nano Scale

b) Wavelength range: 600 nm to 1000nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
600	2.1	3.6	44.79
700	2.2	3.7	50.63
800	2.3	3.8	56.11
900	2.4	3.9	61.29
1000	2.5	4.0	66.17

Table 6 explains about wave length (nm) from 600 nm to 1000 nm range, core thickness from 2.1 µm to 2.5 µm, cladding refractive index from 3.6 to 4.0 and layer thickness from 44.79 nm to 66.17 nm.

Graph-12:

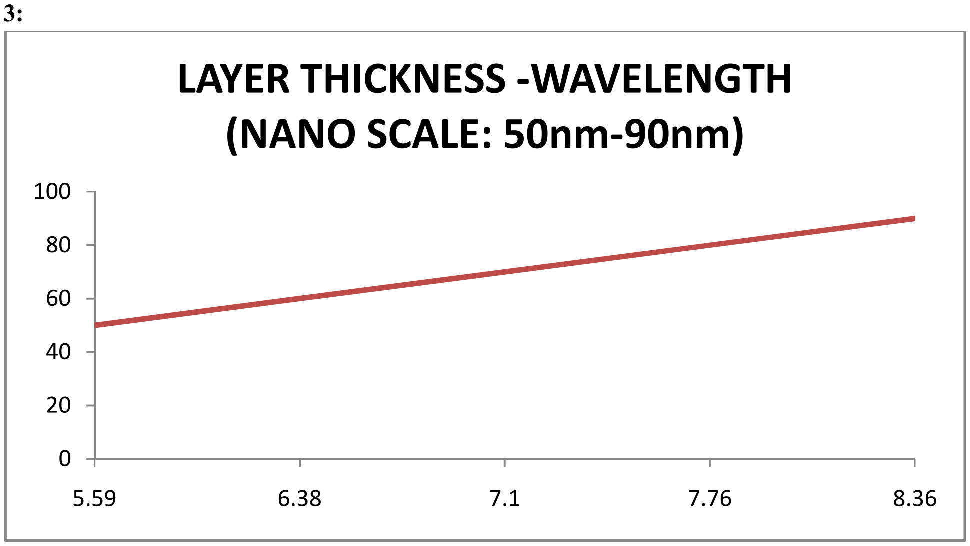


e) Water Medium:
Wavelength range: 50 nm to 90nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
50	1.1	2.6	5.59
60	1.2	2.7	6.38
70	1.3	2.8	7.10
80	1.4	2.9	7.76
90	1.5	3.0	8.36

Table 7 explains about wave length (nm) from 50 nm to 90 nm range, core thickness from 1.1 µm to 1.5 µm, cladding refractive index from 2.6 to 3.0 and layer thickness from 5.59 nm to 8.36 nm.

Graph-13:



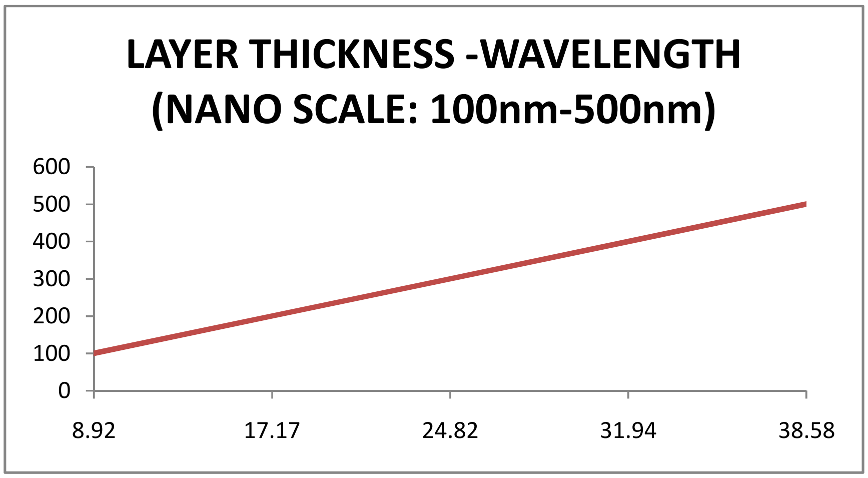
Graph-13 explains about Linear relationship between layer Thickness and Wavelength

Table 8: Wavelength range: 100 nm to 500nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness nm
100	1.6	3.1	8.92
200	1.7	3.2	17.17
300	1.8	3.3	24.82
400	1.9	3.4	31.94
500	2.0	3.5	38.58

Table 8 explains about wave length (nm) from 100 nm to 500 nm range, core thickness from 1.6 µm to 2.0 µm, cladding refractive index from 3.1 to 3.5 and layer thickness from 8.92 nm to 38.58 nm.

Graph-14:



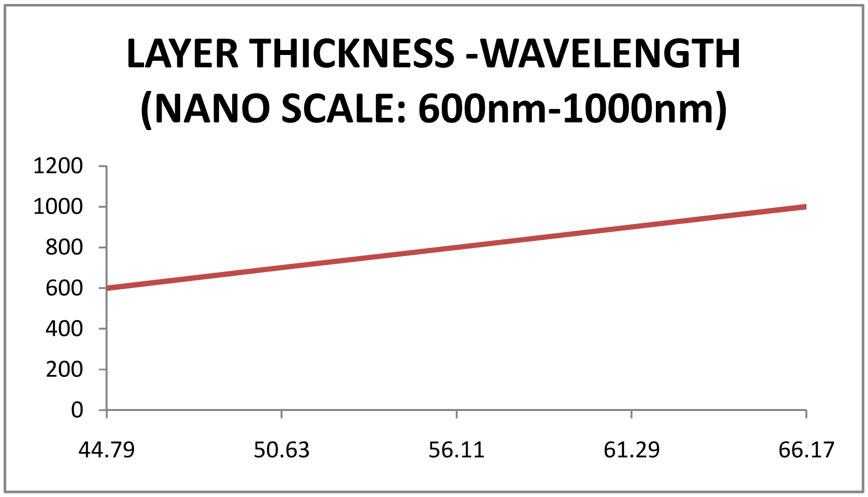
Graph-14 explains about Linar Relationship between Layer thickness and Wavelength in 100nm to 500 nm

Table 9: Wavelength range: 600 nm to 1000nm

Wavelength nm	Core thickness µm	Cladding Refractive index	Layer Thickness Nm
600	2.1	3.6	44.79
700	2.2	3.7	50.63
800	2.3	3.8	56.11
900	2.4	3.9	61.29
1000	2.5	4.0	66.17

Table 9 explains about wave length (nm) from 600 nm to 1000 nm range, core thickness from 2.1 µm to 2.4 µm, cladding refractive index from 3.6 to 3.9 and layer thickness from 44.79 nm to 66.17 nm.

Graph-15:



Graph-15 Explains about Linear Relationship between 600 nm to 1000 nm in correlation between Layer Thickness and wavelength.

IV. Applications in Modern Technology

The utilization of nanotechnology in medication offers some energizing prospects. A few methods are just envisioned, while others are at different phases of testing, or really being utilized today. Nanotechnology in medication includes utilizations of nano particles right now being worked on, just as longer range research that includes the utilization of fabricated nano-robots to make fixes at the cell level. Whatever you call it, the utilization of nanotechnology in the field of medication could reform the manner in which we recognize and treat harm to the human body and ailment later on, and numerous procedures just envisioned a couple of years back are gaining wonderful ground towards turning out to be real factors. One use of nanotechnology in medication as of now being created includes utilizing nano particles to convey drugs, warmth, light or different substances to explicit sorts of cells. Particles are designed with the goal that they are pulled in to infected cells, which permits direct treatment of those cells. This strategy diminishes harm to solid cells in the body and takes into account prior recognition of sickness.

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