ELEXPHOTONICA
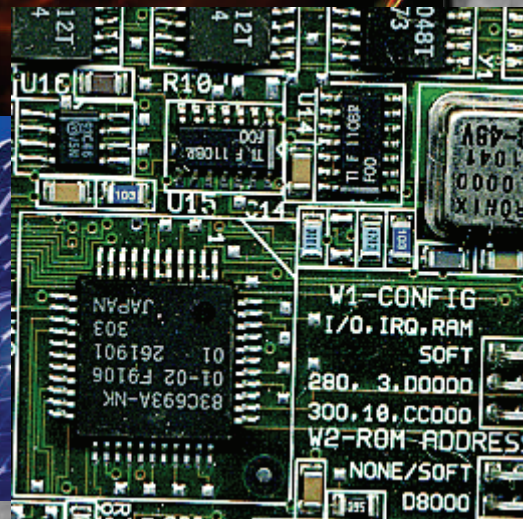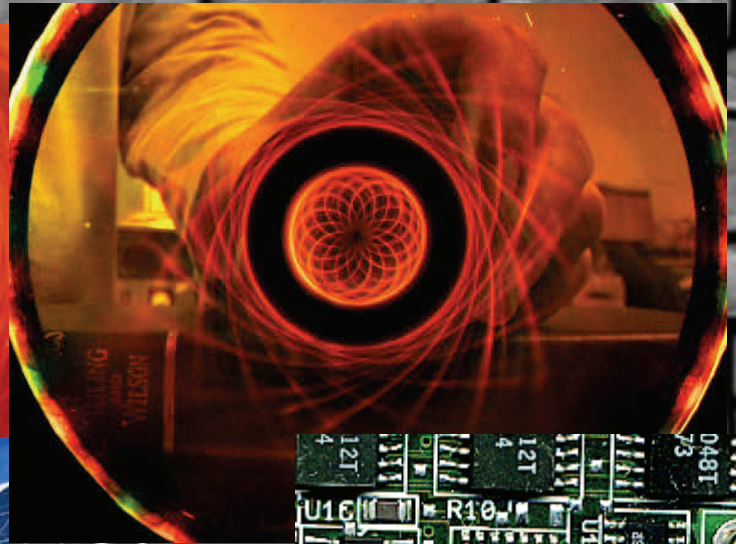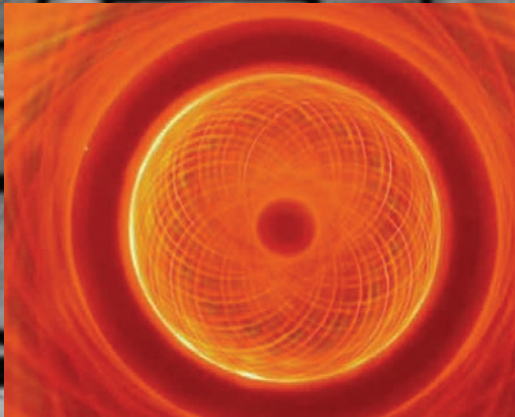
SCHOOL OF STUDIES IN ELECTRONICS & PHOTONICS

Pt. Ravishankar Shukla University, Raipur

Chhattisgarh, India

Editor
Dr. VIVEK KANT JOGI

MESSAGE FROM THE VICE CHANCELLOR

I am really delighted that the first issue of our half yearly e-News letter, "ELEXPHOTONICA " is going to be released on 1 Jan, 2015, to mark the 50th Anniversary of our esteemed University. It has been rightly named ELEXPHOTONICA befits with Pt. Ravishankar Shukla University, as we are the oldest and biggest university of the state, nourishing the quest of knowledge of large groups of people in the society and the state for half a century now. Through our twenty seven schools of studies situated in the campus and 237 affiliated colleges our university has prepared lakhs of youths who are now working today in different facets of their life in the county and abroad. We have drawn of a detailed road map for the future academic expansion and the development of the University for the coming years which will further strengthen its image and status. Our objective is to be one of the premier institutions of higher learning in the country. I hope that through this News letter, our University will bring out its various activities and achievements from time to time to come closer to the people. I hope the ELEXPHOTONICA to be perennial and strive hard to reach the ocean of information and knowledge to full fill its very mission. I wish ELEXPHOTONICA a grant success.

Prof. S. K. Pandey

MESSAGE FORM THE REGISTRAR

I am glad to know the first issue of university news letter ' ELEXPHOTONICA (Bi- annual e-News Letter) is to be published to mark the end of golden jubilee year celebration of the University (1964-2014). I am confident that through this news letter our university will be able to disseminate information about various activities and events to attract and develop interest among public. I am very hopeful that the News Letter will be a regular feature and should go deep in providing information about the achievements and progress of the university with the passage of time to befit its name the ELEXPHOTONICA .

I wish its grand success.

K.K.Chandrakar

PREFACE

I am delighted the School of Studies in Electronics & Photonics, Pt. Ravishankar Shukla University , Raipur is publishing Bi- annual e-News Letter "ELEXPHOTONICA" on 1 Jan. 2015**.**

This Magazine is most important for the faculties/technicians/Students in colleges who are interested in Electronics & Photonics. ELEXPHOTONICA cover the General, Research & Developments, activities and thoughts of Students.

ELEXPHOTONICA will provide latest development & activities of our students & faculties in School of Studies in Electronics & Photonics, Pt. Ravishankar Shukla University.

We express our deep sense of gratitude to Prof. S.K. Pandey Vice-Chancellor for his constant encouragement, support and interest in bringing out this volume. Publishing ELEXPHOTONICA has been possible only because of toils of a band of dedicated members, students & research scholars of SOS in Electronics & Photonics, Pt. Ravishankar Shukla University, Raipur.

We are indebted to University Grants Commission, Chhattisgarh Council of Science & Technology and Chhattisgarh State Renewable Development Agency (CREDA) for timely help and support whatever needed. We are thankful to our sponsors both from Industry and Government agencies without which it would not be possible to provide for the modest arrangements that we have been able to make for you.

I wish the ELEXPHOTONICA a grand success.

<div align="right">Dr. Sanjay Tiwari</div>

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School Of Studies in Electronics & Photonics
Pt. Ravishankar Shukla University, RAIPUR (C.G.) INDIA
Year of Establishment: 1994

Academic program Running with date of establishment

M.Sc. In Electronics since 1994

M.Tech. in Optoelectronics & Laser Technology since 2008.
An UGC National Innovative Scheme for teaching & Research in Innovative & Emerging Areas.

M.Phil. in Electronics Since 2007

Ph.D. in Electronics since 1994

Research Projects

Design and Simulation of Organic Electroluminescent Devices Chhattisgarh Council of Science & Technology [CCOST 2009-2011].

Development and Simulation of Device characteristics of Polymer Devices, Cavendish Lab University of Cambridge, Cambridge UK & UKIERI, 2007-08 .

Simulation of Organic Solar Cells, National Research Award by UGC, 2010-12 .

Thin Film Electroluminescence Displays, UGC under UGC Research Scheme for 3 Year,1999-2002 .

Design and Characterization of Polymer Light Emitting Diodes, UGC Delhi. 2009-12

Fabrication and modeling of PbS/TiO2 Quantum Dot Photovoltaic devices, International Fulbright Commission Washington USA [USIEF 20.10.2010].

Prof. Sanjay Tiwari

Professor Design and Implementation of Image Enhancement Techniques in Frequency Domain , Chhattisgarh Council of Science and Technology, 2008-2010.

Prof. Kavita Thakur

Speaker Identification using DSP tools , UGC, New Delhi, 2001-2003.

National and International Awards

Prof. Sanjay Tiwari

- Awarded US Fulbright Nehru Senior Research Fellowship administered by the Council for International Exchange of Scholars (CIES) and USIEF awarded Fulbright- to work at University of California, Santa Cruz and IBM Almaden Research Center, San Jose.

- International Center for Theoretical Physics awarded Senior Associate ship .

- Honored with UKIERI Award by Cambridge University under UK-India Education and Research Initiative programme to work at Cavendish Lab., University of Cambridge ,U.K.

- Awarded prestigious SAARC fellowship from University Grants Commission of Bangladesh for the year 2007-08 .

- INSA Summer Fellowship to work at BARC ,Mumbai .

- Honored with Best Young Scientist Award of Madhya Pradesh Council of Science & Technology in the year 1994.

- Honored with Prestigious " National UGC Research Award" of University Grants Commission, New Delhi for the year 1999 and 2009.

- Elected Associate Member by Third World Academy for Women for Sciences, Trieste, Italy .

- Nominated by Gov. of India for Commonwealth Academic Staff Fellowship U.K. 2006 .

- American Academy USA has selected one of my research paper as one amongst the best six papers in Optoelectronics, for the year 1995 and published in "Optical reports" America".

Books Published

- Coauthor Physics Part II" & " Physics Part III" Published by Madhya Pradesh Hindi Granth Academy, Bhopal and later on edited Physics Part III.

- Thin Film Electroluminescent Displays Allen Publishers New Delhi .

- Editor: Proceedings of International Conference on traditional and modern Technologies.

Prof. Kavita Thakur

- Recipient of Rashtriya Gaurav Award for year 2010-2011 from IIFS (India International Friendship Society) ,New Delhi, India.

- Recipient of "Best Citizen of India Award" for year 2011 from International Publishing House , New Delhi, India.

- Awarded IEEE Senior Membership by IEEE Signal Processing Society (letter dated 28 November 2012) and Instrumentation and Measurement Society (letter dated 23 October 2012),Piscataway , NJ 08854 , USA .

- Published my Biography in " Morques Who's Who" , NJ 07974 USA.

Books Published

- Phonetic parameters for status recognition of pregnant women

- Author- Kavita Thakur & A. S. Zadganokar ,Publisher- Lab LAMBERT academic Publishing GmbH & Co. KG, Germany, ISBN- 978-3-8465-4338-2.

- A Practical Approach to Frequency Domain Image Enhancement Methods. Quality Assessment of Digital Images.

- Author-G R Sinha , M K Kowar , Kavita Thakur , Publisher- Lab LAMBERT academic Publishing GmbH & Co. KG, Germany, ISBN-978-3-659-17007-2.
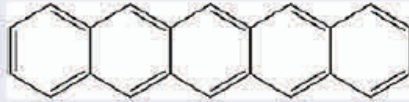
Organic Light-Emitting Diode

Prof. Sanjay Tiwari

What is organic electronics?

- Electronics with carbon-based materials
- Two different groups:

Small-molecular materials

Pentacene
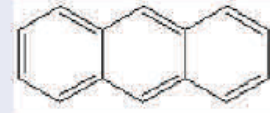
Anthracene

mainly prepared by thermal evaporation

Polymers
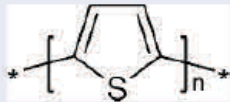
Polythiophene (PT)
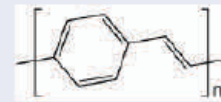
Polyphenylen-vinylene (PPV)

prepared by solution processing (spin-coating, inkjet printing)

Advantages of organic semiconductors

- Light weight
- Mechanical flexibility
- Chemical modifications possible
- Easy and cheap processing (e.g. ink-jet printing, spin coating)

Readius from Polymer Vision

Inorganic Vs. Organic Material Properties

Characteristic	Organic	Inorganic
Structure (Morphology)	✓Amorphous Polycrystalline Crystalline	Amorphous Polycrystalline ✓Single Crystalline
Charge Carrier Properties	Molecular	Lattice
Mobility (cm^2/ Vs)	10^{-3} to 10^{-5}	1 to 1500
Processing	Low Temperature	High Temperature
Synthetic Flexibility	High	Low
Stability	Currently an Issue	Very good

What is an OLED?

An OLED is an electronic device made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. A device that is 100 to 500 nanometers thick or about 200 times smaller than a human hair.
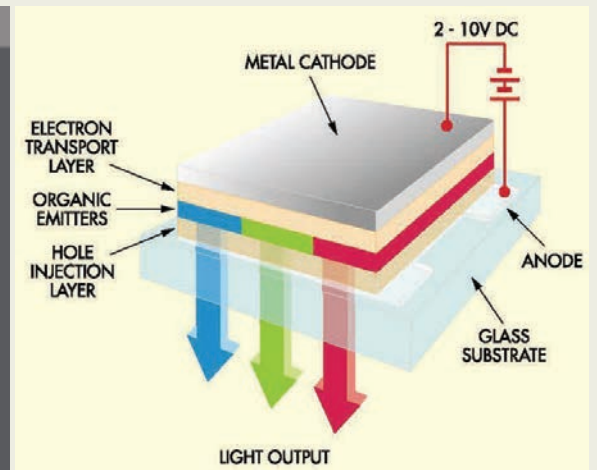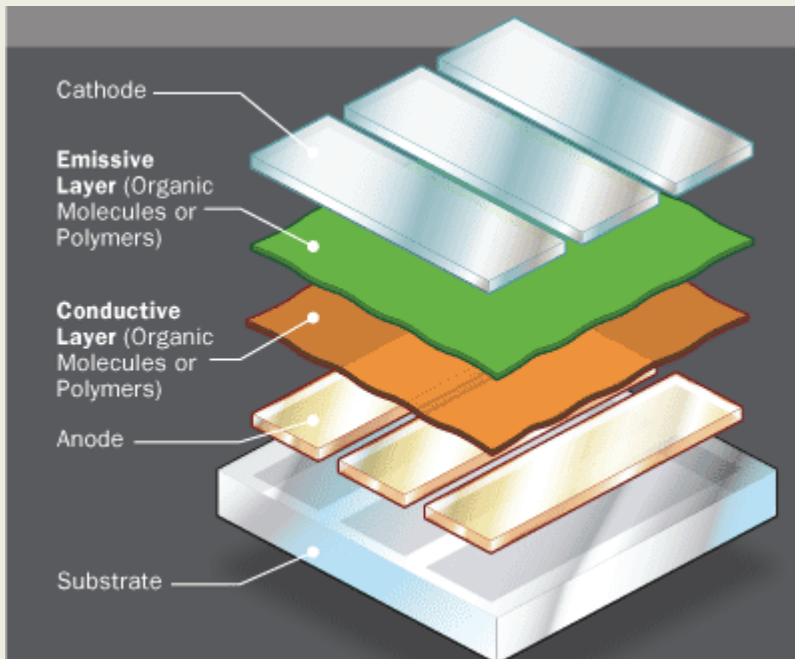
The battery or power supply of the device containing the OLED applies a voltage across the OLED.

An electrical current flows from the cathode to the anode through the organic layers. (an electrical current is a flow of electrons).

At the boundary between the emissive and the conductive layers, electrons find electron holes. The OLED
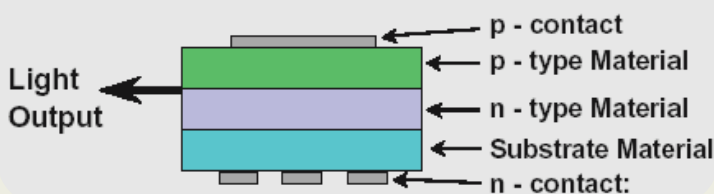
Fabrication of OLEDs

Material purify

Indium-Tinoxide (ITO) 0.1 µm

Glass, PET

Evaporator 1   Evaporator 2

mask   mask

Encapsulation

Successive vacuum deposition of organic layers

Al   Al

LiF

Electron transport layer

Hole blocking layer

Emission layer

Hole transport layer

Hole injection layer

ITO   ITO   ITO

Glass

Electroluminescence

Function: *Creates a resistive contact between the metal and the organic layers*
Example: LiF

Function: *Transports electrons*
Example: Alq3

Function: *Prevents diffusion of holes into the electron transport layer*
Example: BCP

Function: *Charge recombination, light generation*
Example: Luminescent material in an electronically

Function: *Transports holes*
Example: Triarylamines, TPD

Function: *Controls injections of holes, smooths the ITO surface*
Example: CuPc
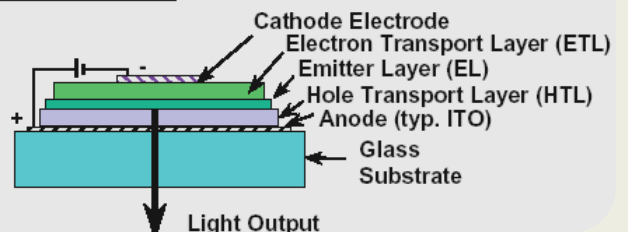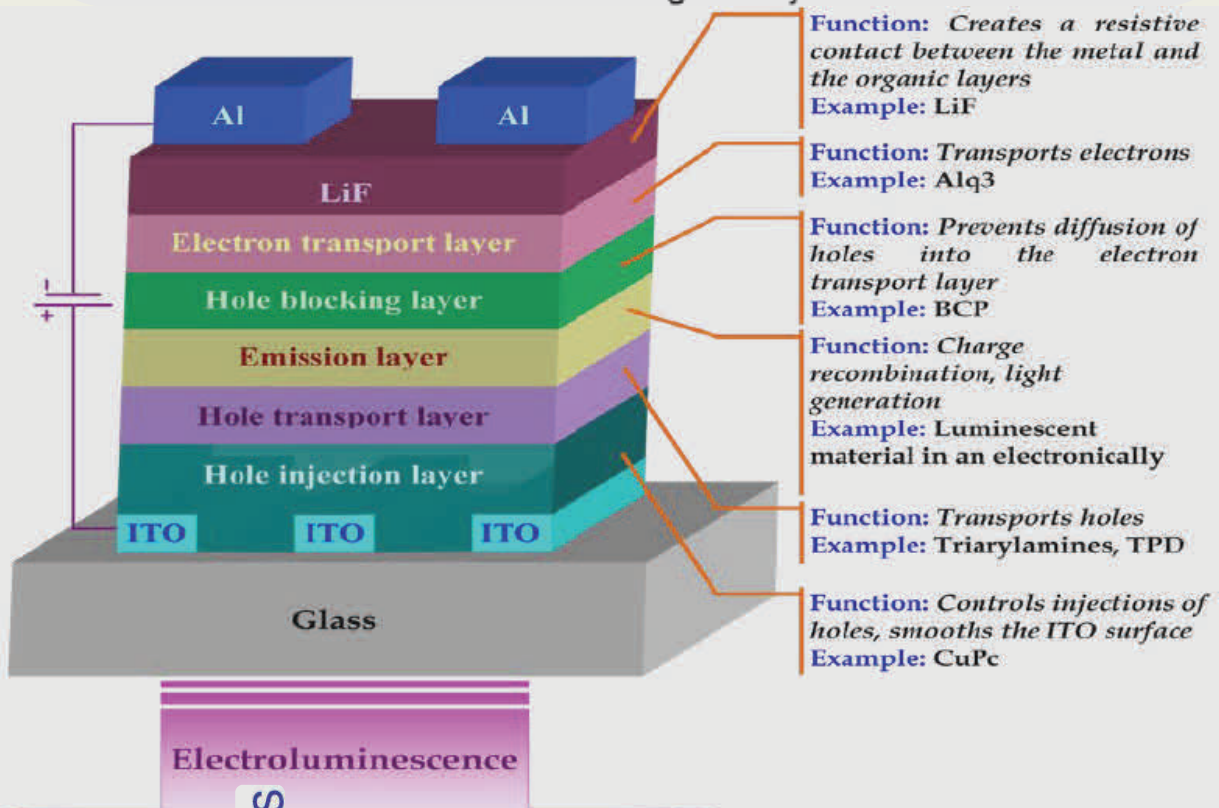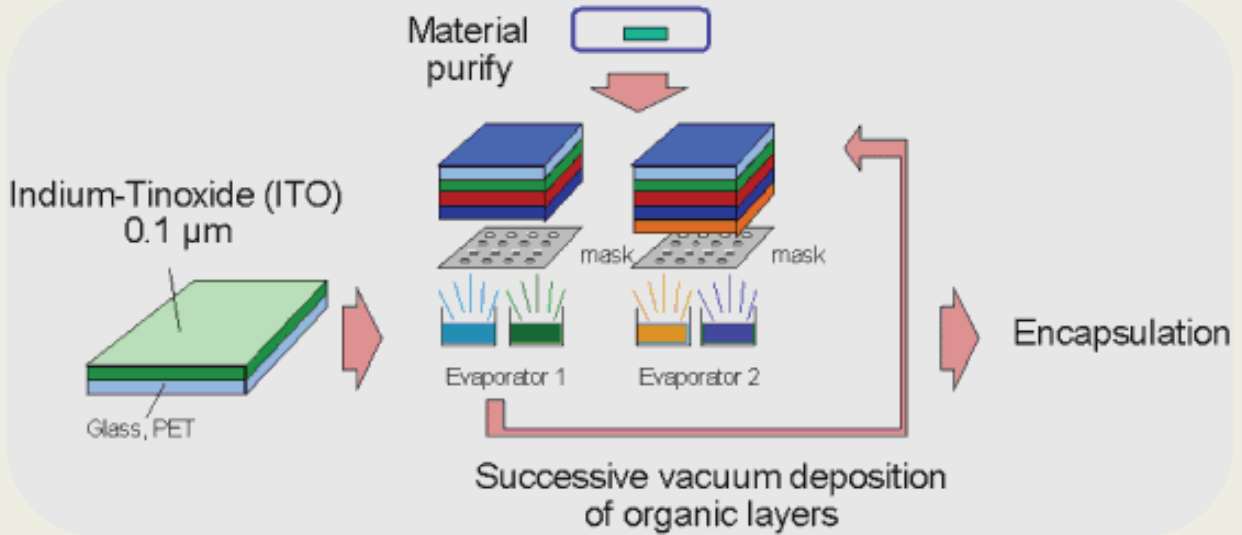
Level Alignment of some Organic Materials and Metals

Φ_M (eV)   Energy (eV)

Sm

Al, In   Mg

Ag

Sn

PEDOT:PSS

Au

NTCDA   TCNQ

F_4-TCNQ

PTCDA

BCP   CBP   PTCBI

F_{16}-CuPc

Alq$_3$

α-NPD   CuPc   α-6T

ZnPc

Pentacene

Transport levels   LUMO   Transport gap   HOMO
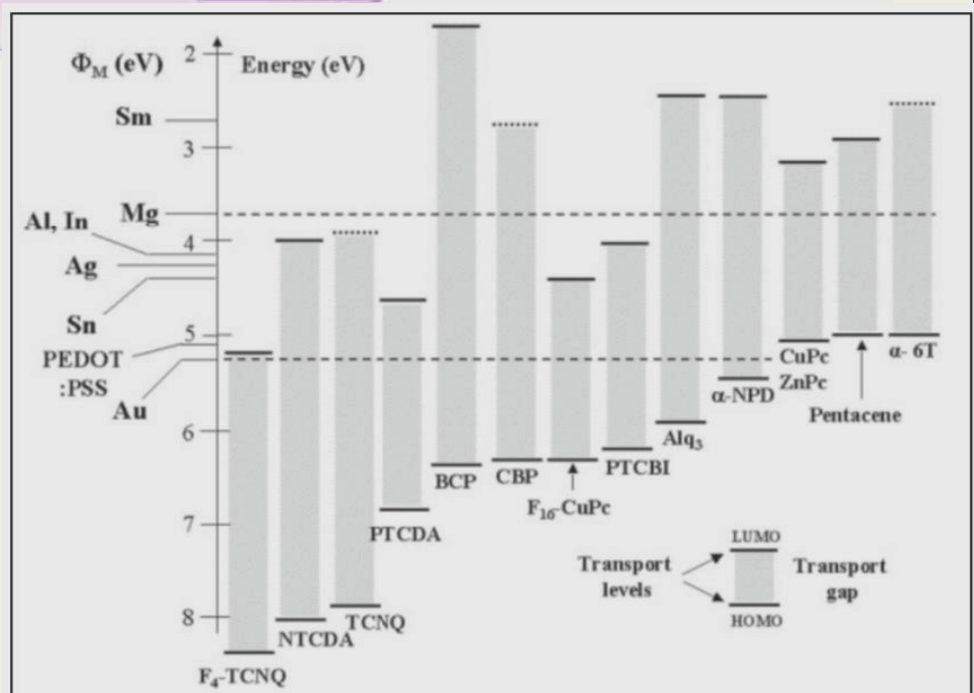
PHOTONIC RESEARCH LAB WITH FOLLOWING FACILITIES

The primary area of expertise of our Photonics Research Lab is Simulation and modeling of optoelectronic devices and deposition of thin-film, solution processable novel semiconducting films. Solution-based processes include spin-coating and spray pyrolysis, and offer room temperature atmospheric deposition of semiconducting thin-films.. Our lab's principle focus is in energy basic related research including photovoltaic, Display devices, solid-state lighting, and planning to extend towards luminescent solar concentrators. Collaborations with UCSC & Cambridge University promote opportunities for combining exciting deposition processes and unique spectroscopic techniques to understand the basic and applied physics of novel thin-film semiconductors.

Modeling , simulation , design and characterization of Polymer Light Emitting Diode (PLED) & Organic Light Emitting Diode (OLED) and Solar Cells are major thrust areas in Electronics .PLED/OLED technology is very energy efficient and lends itself to the creation of ultra-thin film lighting displays that will operate at lower voltages. The group has the developed simulators for single and bi layer devices and through simulations, extensive profiles of transient's electric field, carrier density, current and its components, luminescence and recombination density has been generated.

An interdisciplinary effort to establish a Centre for Organic Electronics as the focus has been initiated to consolidate the gains of experience with organic electronics at Optoelectronic Group. Cavendish Lab, University of Cambridge, Cambridge, UK,IBM San Jose and University of California of faculty member. The study of polymeric materials at nanoscale to engineer properties suitable for electronic applications is the principal goal. The development of Light emitting diodes molecular and Nano materials is the key to this novel effort. In this effort, an advanced photonics laboratory has been setup with basic state of art processing and diagnostic facilities e.g. Thin Film deposition techniques and electrical & optical characterization techniques.

THIN FILM DEPOSITION EQUIPMENT'S

PROGRAMMABLE SPIN COATER

HINDHIVAC VACCUM COATER WITH LNT

SPRAY PYROLYSIS APPARATUS

CHARACTERIZATION SET UP/SIMULATION SOFTWARE

Lab View circuit simulation Software

Mat Lab Software and its Tool Boxes

TFT LCD Video Module

Agilant Semiconductor Parameter Analyzer Test System for I.V.L. Characterization

Laser Optics Lab Kit

Wavelength Division Multiplexer Characterization Set up

Erbium Doped Fiber Amplifier Characterization Set up

Setup for Measurement of Attenuation & Dispersion in Optical Fiber

Keithley Source Meter

Spray Pyrolysis Apparatus

Ellipsometer

Spectrum Analyzer

Solar Cell Setup Ecosense

ANALOG AND DIGITAL LAB.

Opto-Electronics and Microwave Lab.

Analog and Digital Communication Lab.

Microprocessor, Microcontroller & VLSI Design Kit Lab.

Advanced Optical Communication Lab.

Virtual Instrumentation Lab (Lab View).

Advanced computing through MATLAB 2009 (b) and its Toolboxes.

Advanced Instrumentation Lab.

Modeling of MEMS Capacitive Pressure Sensor Using COMSOL

Dr. Vivek Kant Jogi

This tutorial performs an analysis of a hypothetical absolute MEMS pressure sensor. Initially the sensitivity of the device is assessed under ideal operating conditions. Then the effect of packaging induced stress is analyzed, both in terms of the device sensitivity to pressure and an induced sensitivity to temperature. The device geometry is shown in Figure 1. The pressure sensor is part of a silicon die that has been bonded to a metal plate at 70°C. The COMSOL model takes advantage of the symmetry in the geometry and models only a single quadrant of the device.
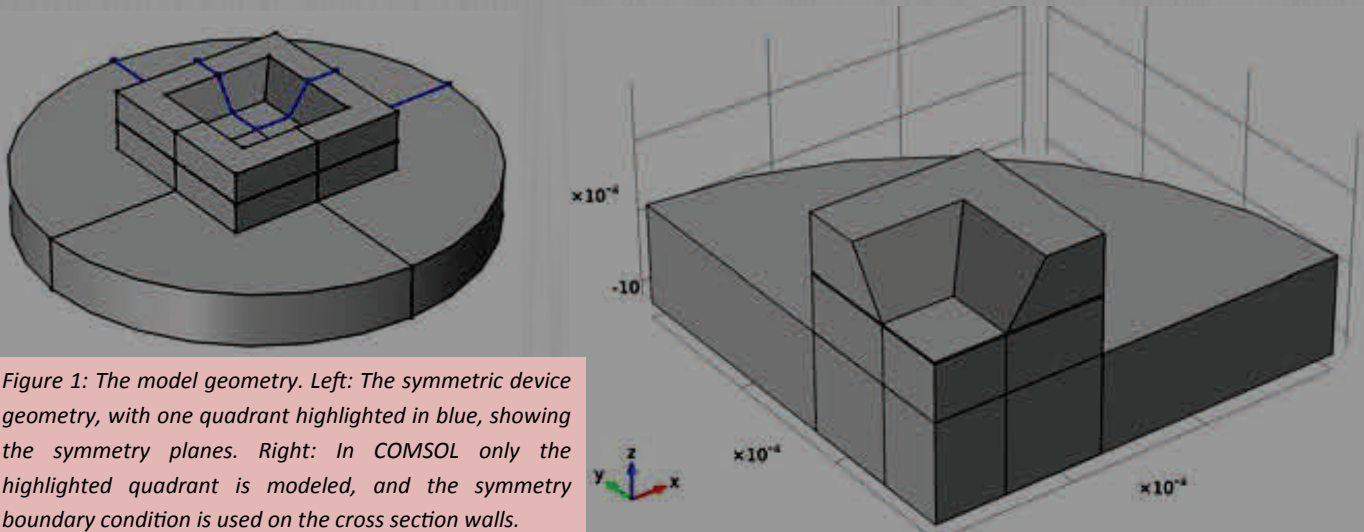

Figure 1: The model geometry. Left: The symmetric device geometry, with one quadrant highlighted in blue, showing the symmetry planes. Right: In COMSOL only the highlighted quadrant is modeled, and the symmetry boundary condition is used on the cross section walls.

A detailed 2D section through the functional part of the device is shown in Figure 2. A thin membrane is held at a fixed potential of 1 V. The membrane is separated from a ground plane by a chamber sealed under high vacuum. The sides of the chamber are insulating to prevent a connection between the membrane and the ground plane (for simplicity the insulating layer is not modeled explicitly in the COMSOL model—this approximation will have little effect on the results of the study).
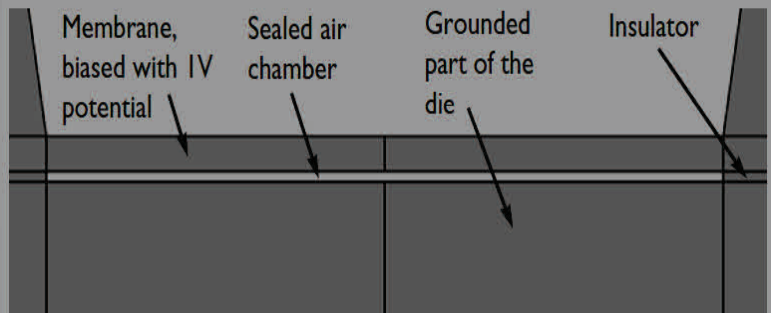
Figure 2: Cross section through the device showing the capacitor. The vertical axis has been expanded to emphasize the gap.
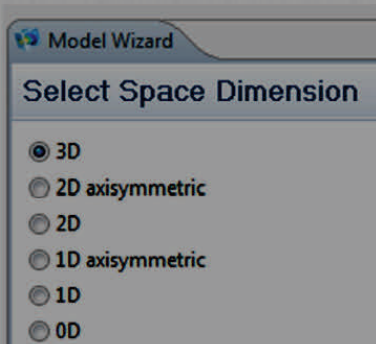
Pressure on the membrane from ambient gas causes the membrane to deflect. The thickness of the air gap now varies across the membrane and its capacitance to ground therefore changes. This capacitance is then monitored by an interfacing circuit, such as the switched capacitor amplifier circuit.

Using the Model Wizard

1. Double-click the COMSOL Multiphysics icon on the desktop. In the

Model Wizard, the default Space Dimension selected is 3D. Click Next.

2. On the Add Physics page, under Structural Mechanics, double-click Electromechanics (emi) to add it to the Selected physics list. You can also click the Add Selected button or right-click and choose Add Selected. Click Next. On the Studies window under Preset Studies, click Stationary. Click Finish.

Geometry 1

The build the geometry as shown in figure 1. Since the structure is symmetric, only a quarter of the physical geometry is required. Then Click the Build All button.

Global Definitions Parameters

1. In the Model Builder, right-click Global Definitions and choose Parameters.

2. In the settings window under Parameters, enter the following settings in the Parameters table.

Definitions

Next add a model coupling operator to compute a derived global quantity from the model. These operators can be convenient for post-processing and COMSOL's solvers can also u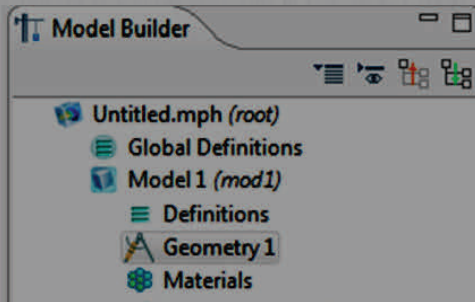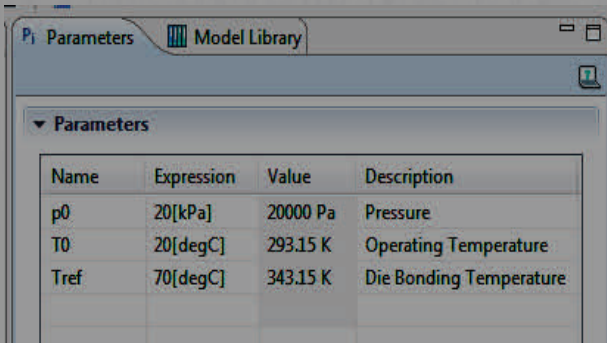se them during the solution process, for example to include integral quantities in the equation system. Here an average operator is added so that the average displacement of the diaphragm can be computed and a point integration is used to make available the displacement of the center point of the diaphragm.

Average 1

1. In the Model Builder, under Model 1 right-click Definitions and choose Model Couplings > Average .

2. In the Average settings window, locate the Source Boundaries section. From the Geometric entity level list, choose Boundary.

3. Select Boundary 12. Note that there are several methods to select a geometric entity. To select, for example, a boundary, left click in the geometry until the required boundary is highlighted, then right click. Alternatively, in the View menu, choose Selection list to display a list of the available boundary numbers. Once again boundaries are added to the selection by first left clicking and then right clicking the item in the list.

Integration 1

1. In the Model Builder, right-click Definitions and choose Model Couplings > Integration .

2. In the Integration settings window, locate the Source Selection section.

3. From the Geometric entity level list, choose Point. Select Point 4 only.

Next, define selections to simplify the set up of materials and physics.

Box 1

1. In the Model Builder, right-click Definitions and choose Selections >Box .

2. In the Box settings window, locate the Geometric Entity Level section.

3. From the Level list, choose Boundary. Locate the Box Limits section. In the x maximum field, enter 1e-6.

4. Locate the Output Entities section. From the Include entity if list, choose Entity inside box.

5. Under Model 1>Definitions, right-click Box 1 and choose Rename (or press F2).

6. Go to the Rename Box dialog box and enter YZ Symmetry Plane in the New name field. Click OK.

Box 2

1. Right-click Definitions and choose Selections >Box .

2. In the Box settings window, locate the Geometric Entity Level section.

3. From the Level list, choose Boundary. Locate the Box Limits section. In the y maximum field, enter 1e-6.

4. Locate the Output Entities section. From the Include entity if list, choose Entity inside box. Click Box 2 and press F2. Enter XZ Symmetry Plane in the New name field. Click OK.

Box 3

1. Right-click Definitions and choose Selections >Box .

2. In the Box settings window, locate the Box Limits section. In the z maximum field, enter -100e-6.

3. Locate the Output Entities section. From the Include entity if list, choose Entity inside box. Click Box 3 and press F2. Enter Steel Base in the New name field. Click OK.

Explicit 1

1. Right-click Definitions and choose Selections >Explicit .

2. Select Domain 3 only. Click Explicit 1 and press F2. Enter Cavity in the New name field. Click OK.

Explicit 2

1. Right-click Definitions and choose Selections >Explicit .

2. In the Explicit settings window, locate the Input Entities section. Select the All domains check box.

3. Click Explicit 2 and press F2. Enter All domains in the New name field. Click OK.

Difference 1

1. Right-click Definitions and choose Selections >Difference

2. In the Difference settings window, locate the Input Entities section.

3. Under Selections to add, click Add . Go to the Add dialog box.

4. In the Selections to add list, select All domains. Click OK.

5. In the Difference settings window, locate the Input Entities section. Under Selections to subtract, click Add .

6. Go to the Add dialog box. In the Selections to subtract list, select Cavity. Click OK.

7. Click Difference 1 and press F2. Enter Linear Elastic in the New name field. Click OK.

Electromechanics

Next the physics settings are added to the model. These include the pressure forces acting on the sensor, the applied sense voltage and other appropriate boundary conditions. In the Electromechanics Interface the Linear Elastic Material is used to solve the equations of structural mechanics only. The electric field does not penetrate these regions.

Linear Elastic Material 1

1. In the Model Builder, right-click Electromechanics and choose the domain setting Linear Elastic Material.

2. In the Linear Elastic Material settings window, locate the Domain Selection section.

3. From the Selection list, choose Linear Elastic. Apply the structural symmetry boundary condition on the symmetry boundaries.

Symmetry 1

1. Right-click Electromechanics and choose the boundary condition Structural >Symmetry . Note that the drop down menu shows domain conditions at the top with boundary, edge and point conditions in separate sections underneath them.

2. In the Symmetry settings window, locate the Boundary Selection section. From the Selec-

tion list, choose XZ Symmetry Plane.

Symmetry 2

1. Right-click Electromechanics and choose the boundary condition Structural >Symmetry .

2. In the Symmetry settings window, locate the Boundary Selection section. From the Selection list, choose YZ Symmetry Plane. Note that the electrical symmetry boundary condition (the Zero Charge feature) is applied by default.

3. The motion of the structure is constrained in most directions by the structural symmetry boundary conditions. However, the whole device can still slide up and down the z-axis. Apply a point constraint to prevent this.

Prescribed Displacement 2

1. Right-click Electromechanics and choose Points >Prescribed Displacement Select Point 44 only.

2. In the Prescribed Displacement settings window, locate the Prescribed Displacement section. Select the Prescribed in z direction check box. Apply a boundary load to represent the pressure acting on the top surface of the diaphragm.

Boundary Load 1

1. Right-click Electromechanics and choose the boundary condition Structural >Boundary Load .

2. Select Boundary 13 only. In the Boundary Load settings window, locate the Force section. From the Load type list, choose Pressure. In the p field, enter p0.

Moving mesh boundary conditions must be applied on boundaries where the air domain deforms and where the default, Electromechanical Interface boundary condition does not apply. The electromechanical interface boundary condition automatically obtains its selection from the interface between structural and deforming air domains. It applies the appropriate electrical forces to the structural layer and constrains the deformation of the air domain to be equal to that of the structure.

Prescribed Mesh Displacement 1

1. In the Model Builder, under Electromechanics click Prescribed Mesh Displacement 1.

2. In the Prescribed Mesh Displacement settings window, locate the Prescribed Mesh Displacement section.

3. Clear the Prescribed z displacement check box. Doing this allows the membrane (and the mesh) to move in the z-direction.

Add terminal and ground features to the model to apply boundary conditions for the electrostatics parts of the problem.

Terminal 1

1. Right-click Electromechanics and choose the boundary condition Electrical >Terminal .

2. Select Boundary 12 only. In the Terminal settings window, locate the Terminal section. From the Terminal type list, choose Voltage. The default value of 1 V is fine in this instance.

Ground 1

1. Right-click Electromechanics and choose the boundary condition Electrical >Ground.

2. Select Boundary 9 only.

Materials

The pressure sensor consists of a silicon die with an enclosed cavity. The pressure sensor is bonded onto a cylindrical steel plate during the packaging process. COMSOL includes a Material Library with many predefined material properties. A predefined material is used for the steel plate, but the silicon is set up as a user-defined material, as for this model isotropic material parameters are used to enable direct comparison with the results in Practical MEMS. The cavity also needs 'material' properties (to define the relative permittivity) and a user defined material is used to set the relative permittivity to 1 in this region.

Material 1

1. In the Model Builder, under Model 1 right-click Materials and choose Material .

2. In the Material settings window, locate the Material Contents section. In the table, enter the following settings:

3. Under Materials, right-click Material 1 and

PROPERTY	NAME	VALUE
Relative permittivity	epsilonr	11.7
Young's modulus	E	170[GPa]
Poisson's ratio	nu	0.06
Density	rho	2330

choose Rename. Go to the Rename Material dialog box and enter Silicon in the New name field. Click OK.

By default the silicon is in all domains. Some of these selections will be overridden as other materials are added.

Material 2

1. Right-click Materials and choose Material. In the Material settings window, locate the Geometric Entity Selection section.

2. From the Selection list, choose Cavity. In the

PROPERTY	NAME	VALUE
Relative permittivity	epsilonr	1

Material settings window, locate the Material Contents section. In the table, enter the following settings:

3. Under Materials, right-click Material 2 and choose Rename. Go to the Rename Material dialog box and enter Vacuum in the New name field. Click OK.

Steel AISI 4340

1. In the Model Builder window right-click Materials and choose Open Material Browser.

2. In the Material Browser window, locate the Materials section.

3. In the tree, under Built-In, right-click Steel AISI 4340 and choose Add Material to Model.

4. In the Model Builder, under Model 1>Materials click Steel AISI 4340. In the Material settings window, locate the Geometric Entity Selection section. From the Selection list, choose Steel Base.

Mesh 1

Next set up a structured mesh to solve the problem on.

Size

1. In the Model Builder under Model 1, right-click Mesh 1 and choose Edit Physics-Induced Sequence.

Disable the default free tetrahedral mesh.

Free Tetrahedral 1

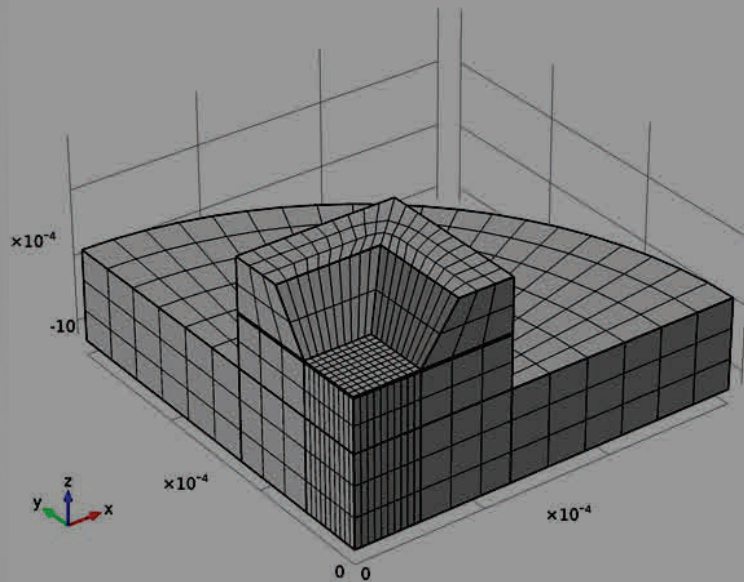1. In the Model Builder under Mesh 1, right-click Free Tetrahedral 1 and choose Disable .

Set a maximum element size on the sensor diaphragm.

Size 1

1. Right-click Mesh 1 and choose Size. In the Size settings window, locate the Element Size section.

2. Click the Custom button. Locate the Element Size Parameters section. Select the Maximum element size check box. In the associated field, enter 50e-6.

3. Locate the Geometric Entity Selection section. From the Geometric entity level list, choose Boundary. Select Boundary 3 only.

Create a mapped mesh on the lower surface of the device.

Mapped 1

1. In the Model Builder, right-click Mesh 1 and choose More Operations >Mapped.

2. Select Boundaries 3, 16, and 32 only. Click the Build All button.

Sweep the surface mesh through the structure.

Swept 1

1. In the Model Builder, right-click Mesh 1 and choose Swept. In the Settings window, click Build All.

Study 1

Set up a study that sweeps over a range of applied pressures, so that the response of the sensor can be assessed.

Step 1: Stationary

1. In the Model Builder, expand the Study 1 node, then click Step 1: Stationary.

2. In the Stationary settings window, click to expand the Study Extensions section. Select the Continuation check box.

3. Click Add. The continuation parameter p0 (Pressure) is added by default. This is the correct parameter to sweep over.

4. Click the Range button. Go to the Range dialog box. In the Start field, enter 0. In the Step field, enter 5000. In the Stop field, enter 25000. Click the Add button.

5. In the Model Builder, right-click Study 1 and choose Compute.

Results

Much of the structure is not displaced in this initial study. To facilitate post processing, add a selection to the solution. This will ensure that only the domains of interest are displayed in post processing.

Data Sets

1. In the Model Builder, expand the Results >Data Sets node. Right-click Solution 1 and choose Add Selection.

2. In the Selection settings window, locate the Geometric Entity Selection section. From the Geometric entity level list, choose Domain. Select Domains 3 and 4 only.

Displacement (emi)

1. In the Model Builder, select the Results >Displacement (emi) node.

2. Click the Zoom Extents button on the Graphics toolbar.

The plot now shows the displace-

p0(6)=25000 Surface: Total displacement (m)
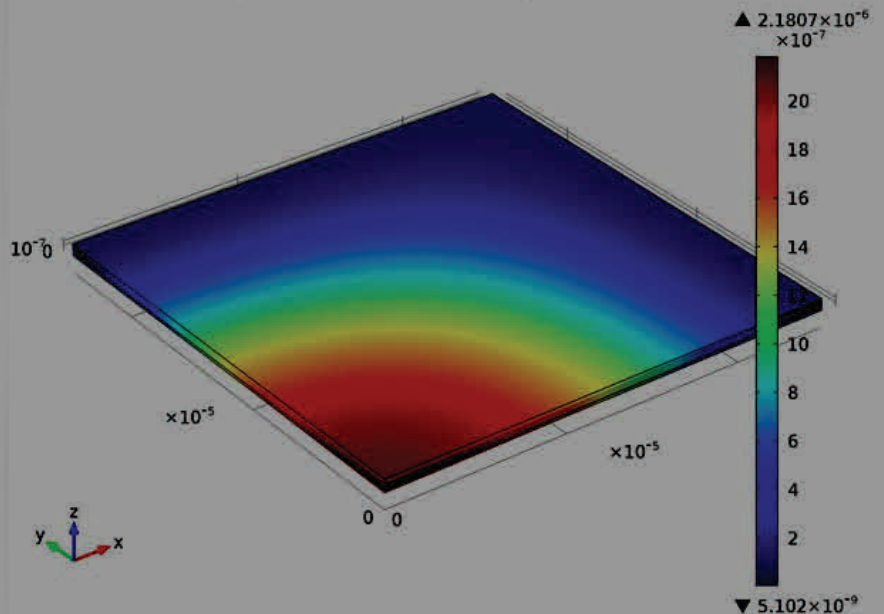
ment of the diaphragm only, which, as expected, is maximum in the center of the sensor.

Next, plot the electric potential in an xy-oriented plane between the sensor diaphragm and the ground plane.

Potential (emi)

1. In the Model Builder, expand the Potential (emi) node , then click Slice 1. In the Slice

settings window, locate the Plane Data section. From the Plane list, choose xy-planes.

2. In the Planes field, enter 1. Select the Inter-

p0(6)=25000 Slice: Electric potential (V)

active check box. In the Shift field, enter -5.8E-6. Click the Plot button.

Due to the deformation of the diaphragm the potential is non-uniformly distributed in the plane.

Next the deformation of the diaphragm is plotted as a function of the pressure difference across it. Both the average and the maximum displacement are plotted.

1D Plot Group 3

1. In the Model Builder, right-click Results and choose 1D Plot Group. Right-click 1D Plot Group 3 and choose Global.
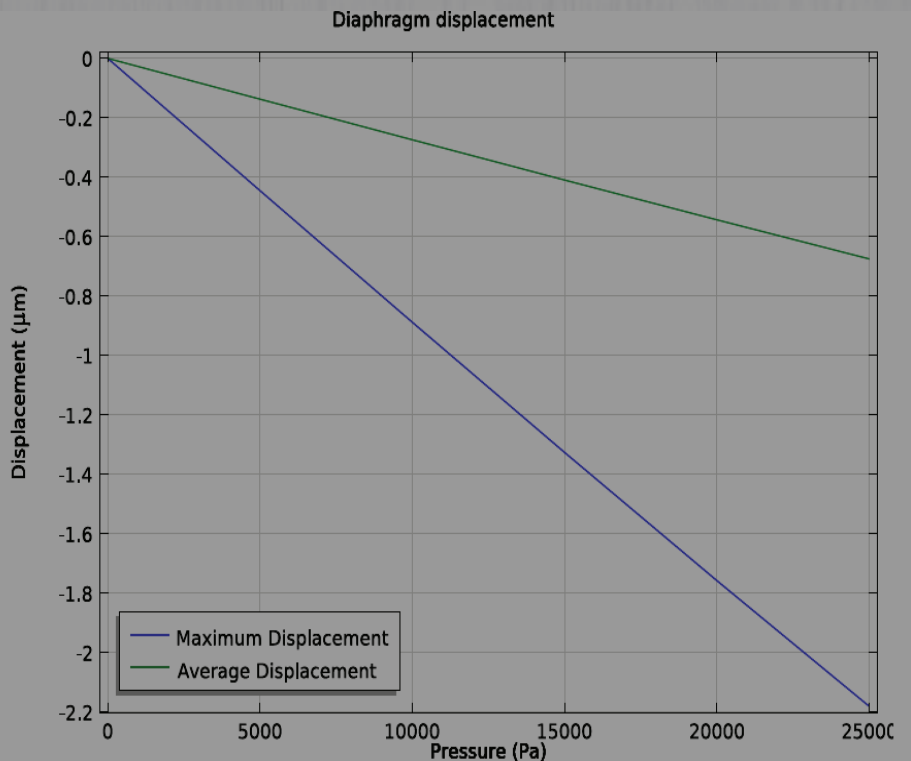
Use the point integration and surface average operators de-

EXPRESSION	UNIT	DESCRIPTION
intop1(w)	um	Maximum Displacement
aveop1(w)	um	Average Displacement

fined earlier to evaluate the displacement at the mid-point of the membrane and the average displacement.

1. In the Global settings window, locate the y-Axis Data section. In the table, enter the following settings:

2. In the Model Builder, click 1D Plot Group 3. In the 1D Plot Group settings window, click to expand the Title section.

3. From the Title type list, choose Manual. In the Title field, enter Diaphragm Displacement.
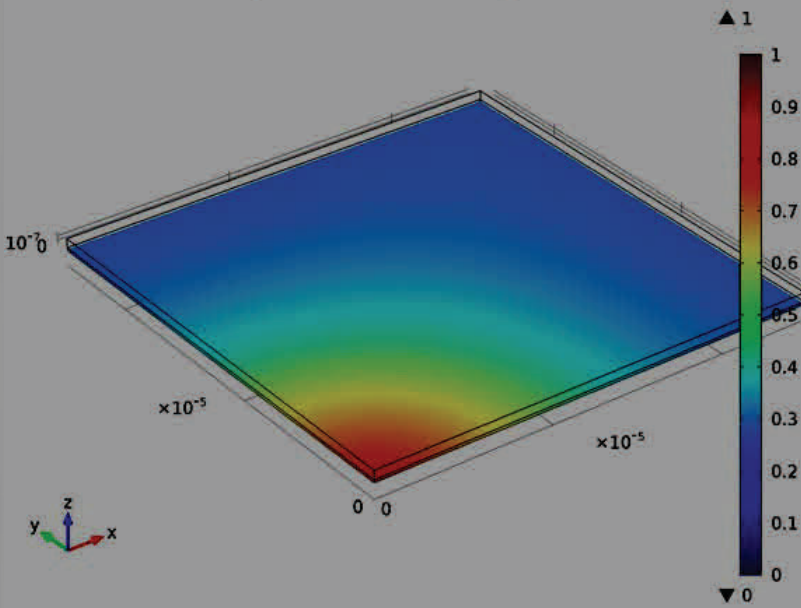
4. Locate the Plot Settings section. Select the x-axis label check box. In the associated field, enter Pressure (Pa). Select the y-axis label check box.

5. In the y-axis label field, enter Displacement (\mu m). Click to expand the Legend section. From the Position list, choose Lower left.

6. Right-click 1D Plot Group 3 and choose Rename. Go to the Rename 1D Plot Group dialog box and enter Diaphragm Displacement vs. Pressure in the New name field. Click OK.

7. Right-click Diaphragm Displace-

Diaphragm displacement

ment vs. Pressure and choose Plot.

At an applied pressure of 10 kPa the diaphragm displacement in the center is 0.89 μm. The average displacement of the diaphragm is 0.27 μm. These values are in good agreement with the approximate model given in Practical MEMS (maximum displacement 0.93 μm, average displacement 0.27 μm). Now plot the sensor capacitance as a function of

the applied pressure. If the switched capacitor amplifier described in Practical MEMS is used to produce the output, the sensor output or transfer function is directly proportional to the change in capacitance.

1D Plot Group 4

1. Right-click Results and choose 1D Plot Group.

2. In the Model Builder, under Results right-click 1D Plot Group 4 and choose Global.

Since the terminal boundary condition was used for the underside of the diaphragm, COMSOL automatically computes its capacitance with respect to ground. The value of the capacitance is available as a post processing variable.

3. In the Global settings window, click Replace Expression in the upper-right corner of the y-Axis Data section. From the menu, choose Electromechanics >Terminals >Capacitance

| EXPRESSION	UNIT	DESCRIPTION
emi.C11	pF	Capacitance
0.738[pF]*(1+8.87e-6[1/Pa]*p0)	pF	Linearized Analytic Capacitance

(emi.C11).

Next, compare the computed capacitance with the small displacement, linearized analytic expression derived in Practical MEMS.

4. Locate the y-Axis Data section. In the table, enter the following settings:

5. In the Model Builder, click 1D Plot Group 4. In the 1D Plot Group settings window, locate the Title section. From the Title type list, choose Manual. In the Title text area, enter Model Capacitance vs. Pressure.

6. Locate the Plot Settings section. Select the x-axis label check box.

7. In the associated field, enter Pressure (Pa). Select the y-axis label check box. In the associated field, enter Capacitance (pF). Click to expand the Legend section. From the Position list, choose Upper left.

8. Right-click 1D Plot Group 4 and choose Rename. Go to the Rename 1D Plot Group dialog box and enter Model Capacitance vs. Pressure in the New name field. Click OK.

9. Right-click Model Capacitance vs. Pressure and choose Plot.

The capacitance of the sensor increases with applied pressure. The gradient of the curve plotted gives a useful measure of the response of the device. At the origin the response of the model (1/4 of the whole sensor) is 7×10^{-6} pF/Pa, compared to the analytical response of 7×10^{-6} pf/Pa. The response for the whole sensor is therefore 29×10^{-6} pF/Pa compared to the analytic value of 26×10^{-6} pF/Pa. With the measurement circuit proposed in Practical

Model Capacitance vs Pressure
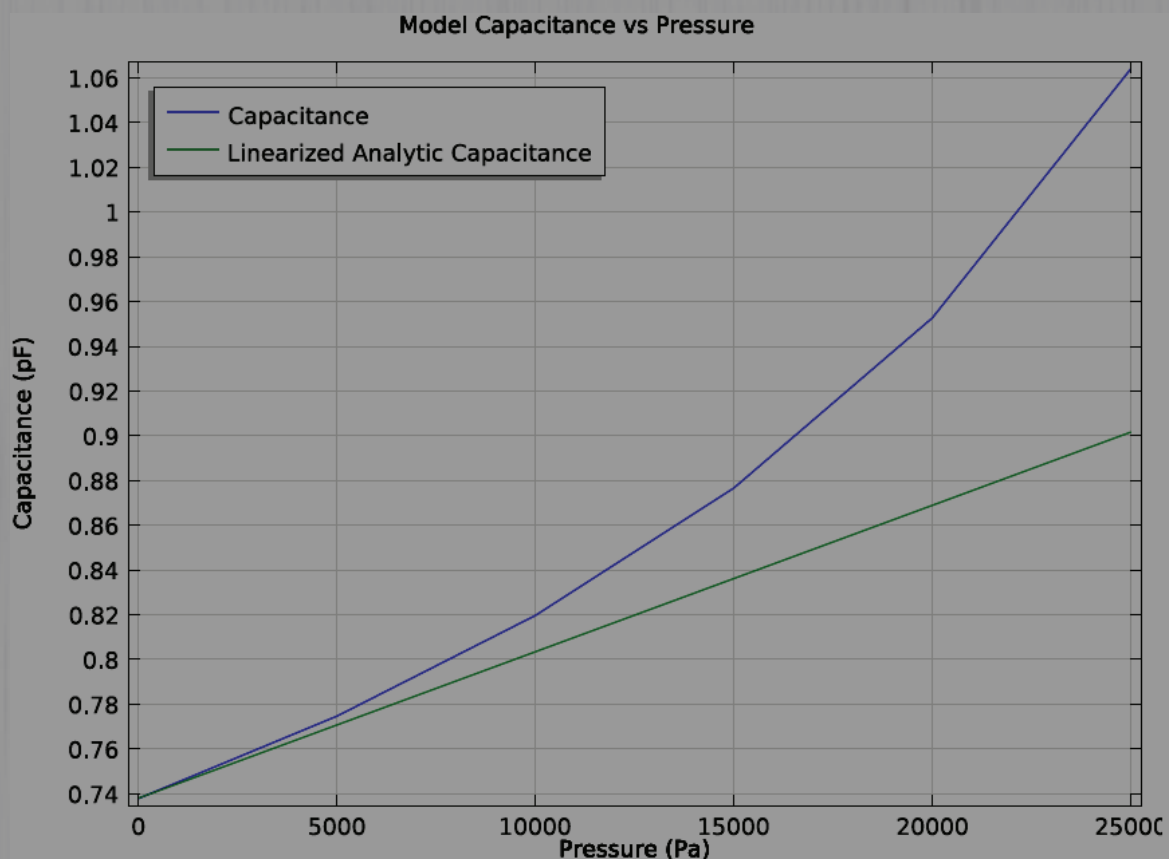
SHUTI NAKAMURA
Nobel Prize for Physics 2014 –Invention of Blue LEDs
Sketched by Niyati Agrawal
M. Tech. 1st Semester

CHHATTSIGARH MAKING ITS CONTRIBUTION TO INTERNATIONAL SCIENTIFIC COMMUNITY

Isamu Akasaki, Hiroshi Amano and Shuji Nakamura are rewarded for inventing a new energy efficient and environment-friendly light source – the blue light-emitting diode (LED). In the spirit of Alfred Nobel, the Prize awards an invention of greatest benefit to mankind; by using blue LEDs, white light can be created in a new way. With the advent of LED lamps we now have more long-lasting and more efficient alternatives to older light sources. Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura developed the blue light-emitting diode (LED) in Japan in the early 1990s, triggering a "fundamental transformation of lighting technology," according to a press release from the Royal Swedish Academy of Sciences, which awarded the prize.

School of Studies in Electronics & Photonics, Pt. Ravishankar Shukla University, Raipur has been working on the development of efficient Organic Blue LED. Professor Sanjay Tiwari has completed major international funded project and guided Dr. Jitendra Kumar Sharma & Dr. Vivek Kant Jogi to the award of PhD Degree. Dr. Jitendra Kumar Sharma has been awarded to Chhattisgarh Young Scientist 2014. Professor Sanjay Tiwari efforts has raised the Department research capabilities in development of Modeling, simulation, design and characterization of Polymer Light Emitting Diode (PLED) & Organic Light Emitting Diode (OLED) and Solar Cells are major thrust areas in Electronics. PLED/OLED technology is very energy efficient and lends itself to the creation of ultra-thin film lighting displays that will operate at lower voltages. The group has the developed simulators for single and bi layer devices and through simulations, extensive profiles of transient's electric field, carrier density, current and its components, luminescence and recombination density has been generated. The article "High Performance Polymer Light Emitting Devices" published in World Journal of Nano Science and Engineering, 2014 shows the Organic Blue LED made in Research laboratory of School of Studies in Electronics & Photonics with high efficiency developed by Dr. Vivek Kant Jogi.

Red and green diodes had been around for several years, but adding blue diodes allowed a mix that could produce practical white-light LED bulbs.

LEDs use less energy than do other forms of lighting, including compact fluorescent (CFL) and incandescent bulbs. A typical LED bulb can produce around 83 lumens per watt—a measure of how much brightness you can get from a unit of electrical power—compared with 67 for a compa-

rable CFL bulb and 16 for an incandescent.

LEDs produce light by passing electric current through a semiconductor, whereas incandescent bulbs pass current through a wire filament until it glows from the heat. The wasted heat energy is chiefly why incandescent bulbs are so much less efficient. Most varieties of the incandescent light bulb have been phased out in the United States. (Related: "U.S. Phase-Out of Incandescent Bulbs Continues in 2014.")

LEDs also last about 30 times longer than incandescent bulbs do, according to the Energy Information Administration, and many LED bulb products promise up to 25,000 hours of use—more than 17 years if you used one for about four hours a day.

One of the main barriers to adoption of LEDs has been price: A typical bulb can cost more than twice as much as a comparable CFL. But LED prices are coming down, and use is growing. A recent report from energy research firm IHS noted that "adoption of LEDs is happening at a faster pace than ever before" and predicted that from 2014 on, LEDs would have the largest revenue share of all lighting technologies.

The lighting transformation is not only in residences. LEDs are also being used for street lights, public holiday and decorative displays, commercial buildings, and other large energy users. According to a recent report from the research firm Navigant, installation of LEDs in street lighting worldwide is expected to grow from 13.2 million bulbs in 2014 to more than 116 million in 2023. (Related: "Separating Myth from Fact on LED and CFL Light Bulbs: Five Concerns Addressed.")

LEDs also hold promise for bringing light to the more than 1.5 billion people around the world without access to an electricity grid, the Royal Swedish Academy of Sciences noted. Indeed, several proposed solutions to energy poverty include the distribution of LED lights, particularly solar-powered ones. For example, the Solar Electric Light Fund, a non-profit National Geographic grantee, has installed LED bulbs at hospitals and homes in villages across Africa.

Plasmonic metal nanoparticles for the photothermal therapy used in selective damaging of cancer and tumor cells

Anshu Singh Thakur[*], S.Tiwari and Swati Sahu

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Photo sensitive Plasmonic metal nanoparticles mostly gold and silver are basically required for the treatment of cancer/ tumor cells via photo thermal therapy. Nanophotothermolysis by using pulsed laser and absorbing nanoparticles (e.g. gold nanospheres, nanorods or carbon nanotubes) attached to specific targets has recently demonstrated great potential for selective damage to cancer cells, tumor cells viruses and DNA [1]. Noble metal nanoparticles (MNPs) exhibit unique optical property called surface plasmon resonance (SPR), defined as strong collective oscillations of free electron in metal nanoparticles which is excited at their resonance frequency by the interacting light. In this study we have addressed the effect of laser pulses on the shape of Plasmonic nanoparticles, and the over view how the selective fragmentation of different shape of nanoparticles can be made.
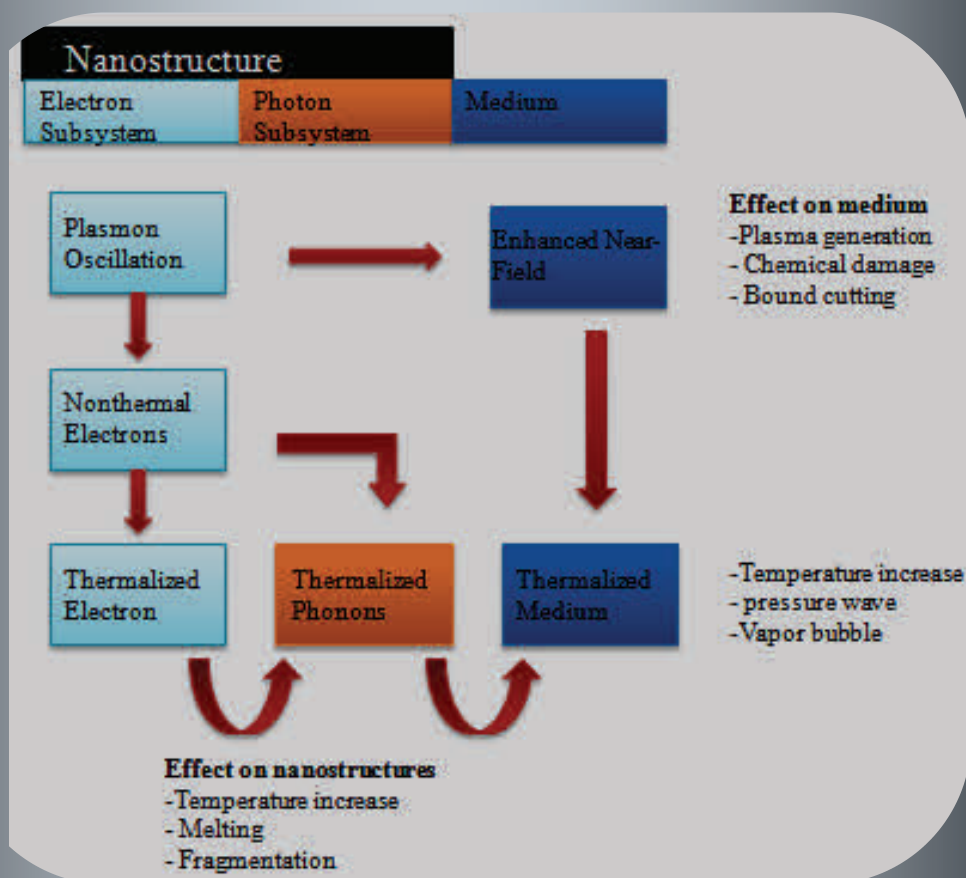
Among noble metal nanostructures, gold nanorods (GNRs) have shown attractive potential for use in many applications because of their anisotropic localized surface plasmon resonance (LSPR) response tunable

across the visible to near infrared region. GNRs are tiny, rod-shaped gold particles with two distinctive different absorption bands arising from the transverse and longitudinal LSPR of free electrons in the visible and near infrared (NIR) regions, respectively. The radiative and photo-thermal properties of GNRs when irradiated with light can be effectively modulated by changing the aspect ratio (length/width). Irradiation of gold nanorods (GNRs) with laser pulses of wavelength matching to the transverse and longitudinal surface plasmon oscillation, results in rapid conversion of electromagnetic energy into heat. This phenomenon is commonly known as the photothermal effect of GNRs [1]. Rise in temperature further modifies the morphological characteristics of GNRs under light irradiation. Using photo-thermal effect of GNRs by laser irradiation, many attractive applications such as controlled drug delivery, imaging, data storage etc are emerging.
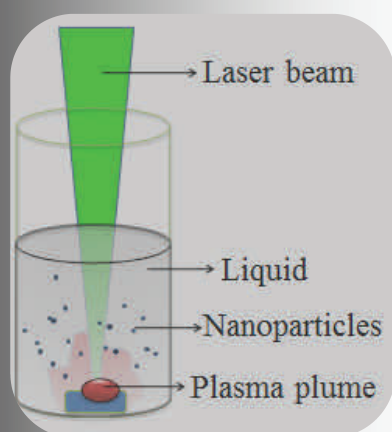
[1] Shuichi Hashimoto, Daniel Wernera, Takayuki Uwada, "Studies on the interaction of pulsed lasers with plasmonic gold nanoparticles toward light manipulation, heat management, and nanofabrication" Journal of photochemistry and photobiology C: photochemistry review 13, 28-54, 2012.

START WHERE YOU STAND

The Past won't help you in beginning new,
If you have left it all behind at last
Why, that's enough, you're done with it, you're through;
This is another chapter in the book,
This is another race that you have planned,
Don't give the vanished days a backward look,
Start where you stand.

The World won't care about your old defeats
If you can start a new and win success;
The future is your time, and time is fleet
And there is much of work and strain and stress;
Forget the buried woes and dead despairs,
Here is a brand new trial right at hand,
The future is for him who does and dares,
Start where you stand.

NIYATI AGRAWAL
M.Tech 1st Semester

First Wireless Telegram

Sketched by Anjali Nagwanshi

Guglielmo Marconi was born on April 25, 1874 at Bologna, an ancient center of learning and education in northern Italy. The 1st wireless company, Wireless Telegraph and Signal Company Ltd. was set up in 1897, with Jameson Davis as its managing director. It had a large capital base of £100,000, which was underwritten by some wealthy investors. The company purchased most of Marconi's patents for £15,000. Later in 1900, name of the company was changed to Marconi Wireless Telegraph Co. Ltd.

Once he even appointed Lord Kelvin, the seventy year old pioneer of British physics, to provide technical advice on one of his wireless projects. In 1899, when he was barely twenty- five, he recruited the then fifty year s old famous electrical engineer J.A. Fleming. Fleming later went on to invent the radio valve. He also employed promising young scientists like C.S. Franklin, who after wards developed short wave radio communication. But in the field of wireless communication he was certainly their superior.

Marconi had realized from the start that his communication system would beat the existing telegraph and cable system, as it was much faster, economical. Marconi made a big show of the public demonstration of the first- ever wireless telegram. He invited Lord Kelvin to send it across the skies. News of the show aroused tremendous interest all over the world. Marconi followed it up with on the spot reporting for the races of the Kingstown Yachting Regatta for the Dublin Express. Soon Marconi was overwhelmed by requests to cover many such events.

**Anjali Nagwanshi
M.Tech. 1st Semester**

शिक्षक

छोटी-छोटी उँगलियो से नापा तिनका घरों का,

चलना तो अब भी आया नहीं,

थामा था हाथों को तुमने किसी दिन,

तुमने भी मुड़ना शिखाया नहीं,

सरोकार का दिन था अपना पुराना,

पढ़ा था जो गिन-गिन कर गिनना दोहराना,

उम्मीदों से बढ़कर पढ़ाया था तुमने,

अपने सपने बुने मेरे कल से तुम्हारे,

कभी भी हमें कुछ बताया नहीं,

सुनी कुछ कहानी तुम्हारी जुबानी,

बनाई नई सोच तुमने पुरानी,

लगन से कुछ रंगों को फिर से बनाया,

तारों को मुट्ठी में भरना सिखाया,

कभी भी हमें जताया नहीं

मुट्ठी में हवा को तुमने सितारा बनाया,

जिंदगी को हिम्मत से जीना सिखाया,

आसमान को रंगों से भरना सिखाया,

तुम्हारा जीवन दर्पण है आदर्श हमारा,

तुम्हारा नमन में ये संसार सारा,

From
Niharika Kothekar
M. Tech 1st Semester

Nd:YAG Laser

The Nd:YAG laser is a solid state laser where the medium is a rod of Yttrium-Aluminum-Garnet doped with Neodymium. This glass like rod is excited by flash-lamps or diodes. The resulting laser light has a wavelength of 1.06um (infrared range); the beam can be transferred to the point of use through an optical fiber, making it very flexible. As they are commercially available at continuous wave (CW) power levels up to 5kW.
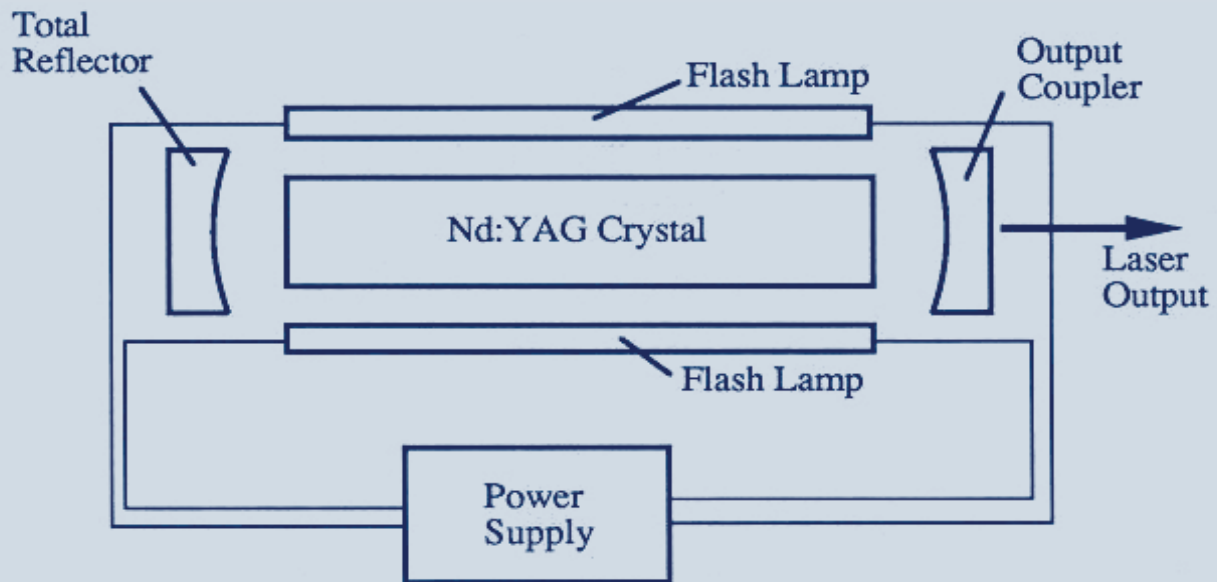

Fig (1).Block Diagram Of Nd-Yag Laser

Nd:YAG lasers are increasingly applied in the industry, especially in applications requiring flexibility like:
  Robotic laser cutting
  Automotive laser welding
  Small component welding

The Nd-YAG laser is an optically pumped solid-state laser that can produce very high-power emissions. This is a result of its lasing medium operating as a four-level system
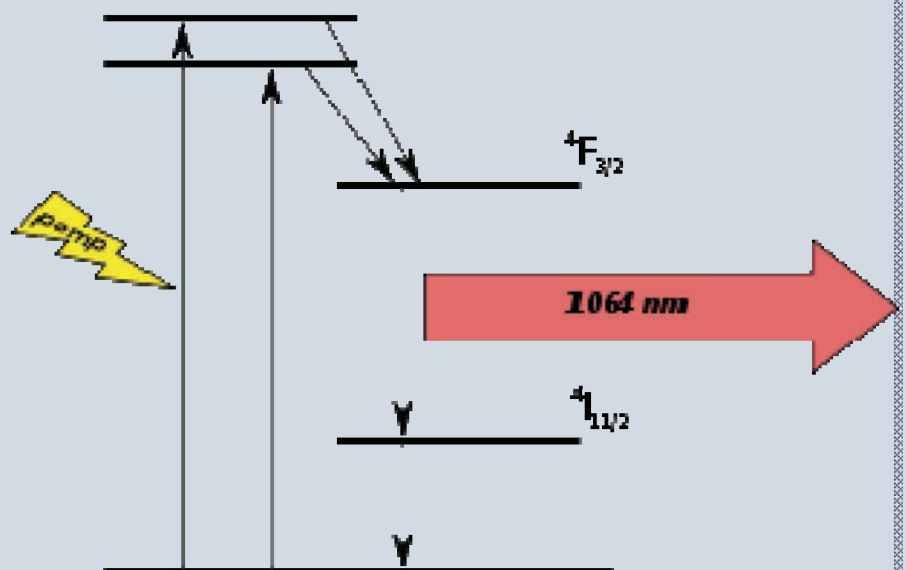

Fig (2).Four Level Schematic Of Nd:Yag Laser

The lasing medium is the colorless, isotropic crystal Y2Al5O12 (Yttrium-Aluminum Garnet - YAG). When used in a laser, about 1% of the Yttrium is replaced by Neodymium. The energy levels of the Nd^{3+} ion are responsible for the fluorescent properties, i.e., active particles in the amplification process.

Population inversion results from shining light on this crystal. If the light is intense enough, atoms within the crystal that absorb this light transition from ground state into the absorption bands This is often done with a flash lamp - often a quartz tube filled with a noble gas through which high energy stored in a capacitor is discharged, emitting in the blue and ultra-violet.

Atoms transition efficiently from their broad absorption bands to the upper energy (laser) levels. The radiative decays to the ground-state from these bands have long life-times, on the order of micro-seconds, as compared to the fast transitions to the upper energy levels (on the order of nano-seconds). Approximately 99% of the ions that are excited to the absorption band transfer to the upper energy levels. These levels are characterized by a relatively long lifetime, on the order of milli-seconds. Due to this long life-time, they de-excite almost solely due to spontaneous emission.

The Nd-YAG laser used in our labs uses a cylindrical crystal. The crystal forms the laser cavity and has reflective ends - one coated so that it is 100% reflective, and the other is either sufficiently reflective, or is coated to allow only part of the amplified light to pass - enough feed-back so that oscillation may occur.

Fig (3). Nd:Yag Laser

Nd:Yag Laser for removal of Cataract : The most common complication of adults having standard extra capsular surgery or phacoemulsification for cataracts camera. It is the clouding of the part of the lens covering (capsule) that remains after surgery, called posterior capsule opacification. If the cloudiness affects your vision, you may choose to have a laser surgery called Nd:YAG posterior capsulotomy to correct this problem.

A laser (Nd:YAG laser) is used to cut a hole in the clouded back lining of the lens capsule to allow light to pass through the membrane to the retina at the back of the eye.

What To Expect After Surgery : Nd:YAG laser posterior capsulotomy is an outpatient procedure. It does not require anesthesia, and it is painless. The person may wait in the outpatient surgery area or the doctor's office for 1 to 2 hours after the procedure so that he or she can have the pressure in the eye (intraocular pressure) checked. Intraocular pressure (IOP) is the pressure caused by the fluid inside the eye that helps keep the shape of the eye.

Why It Is Done : After cataract surgery, some people notice cloudiness (sometimes called after cataract) after several months or years. In some people, it can become very dense and cause as much or more vision loss as the original cataract. The decision to have this procedure is based on the same criteria as the decision to have the original cataract surgery:
  Vision problems are affecting your work or lifestyle.
  Glare caused by bright lights is a problem.
  You cannot pass a vision test required for a driver's license.
  You have double vision.
  The difference in vision between your two eyes is significant.
  You have another vision-threatening eye disease.
The procedure is not needed unless vision loss caused by clouding of the lens capsule is seriously affecting the person's vision and lifestyle.

How Well It Works : Nd:YAG laser posterior capsulotomy reduces glare and improves vision. It lets light pass through cloudy regions of the lens capsule that may develop after cataract surgery.

Risks : The most common complication of Nd:YAG laser posterior capsulotomy is short-term increased pressure inside the eye.

Other risks include:

Detachment of the nerve layer at the back of the eye (retinal detachment).
Swelling of the center of the retina (macular edema).
Damage or displacement of the intraocular lens.
Bleeding into the front of the eye.
Swelling of the clear covering of the eye (corneal edema).

What To Think About : It is common to have a new floater in the eye after this surgery. Nd:YAG laser posterior capsulotomy is not used to prevent clouding of the back lining of the lens capsule (posterior capsule opacification). There is no way to know who will get clouding in the back of the eye after cataract surgery. Certain lenses used in the surgery to remove the cataract may lower this risk and the need for laser surgery later.

As with cataract surgery, it is important to weigh the risks and possible benefits of laser capsulotomy before deciding to have the surgery. About 1 out of 50 people who have laser capsulotomy after cataract surgery develop retinal detachment, which can cause serious vision loss.

Conclusion :

The transmission through glass, Nd:YAG laser's strategic advantage interms of flexibility, is also its main disadvantage. For safety reasons, Nd:YAG lasers are required to be operated in fully enclosed work cells and need special protective equipment to be used by the operator.

While the mode profile of Nd:YAG lasers can prove to be an advantage for applications like butt welding of sheet metal, it is less than optimum for cutting processes.

NIYATI AGRAWAL
M.Tech 1st Semester

SARVAPALLI RADHAKRISHNAN

Sketched by Pukeshwar Harmukn

M. Sc. 1st Semester

Magnetic Levitation

What is a magnet?

§ It is simply an object which produces a magnetic field.

§ North and South are the designations made to describe the two opposite poles.

§ North is attracted to South and repelled by North.

§ South is attracted to North and repelled by South

§ There are three main types: **Permanent Magnets | Soft Magnets | Electromagnets**

Permanent Magnets : Electrons fill atomic orbitals in pairs, If an orbital is full, then one electron spins upward and the other spins downward (Pauli Exclusion Principle), so their magnetic fields cancel out. If an orbital is not full, then the movement of the electron creates a tiny magnetic field. Atoms with several unpaired orbitals have an orbital magnetic moment. In metals, the orbital magnetic moment causes nearby atoms to align in the same direction, creating a ferromagnetic metal. The strength of the magnetic field decreases inversely with the cube of the distance from the magnet's center.

Soft Magnets : These types of magnets do not have a magnetic field of their own. However, when put in the presence of another object's magnetic field, they are attracted (paramagnetic). Once the external magnetic field is removed, they return to their nonmagnetic state.

Electromagnets : The magnetic field is caused by the flow of an electric current. The simplest example is a coiled piece of wire, using the right hand rule, it is possible to determine the direction. An advantage over permanent magnets is that the magnetic field strength can be changed by changing the current.

Nine Ways to Magnetically Levitate an Object

Mechanical constraint | Direct diamagnetic levitation | Superconductors | Diamagnetically-stabilized levitation | Rotational stabilization | Servo stabilization | Rotating conductors beneath magnets | High-frequency oscillating electromagnetic fields | Translational Halbach arrays and Inductrack
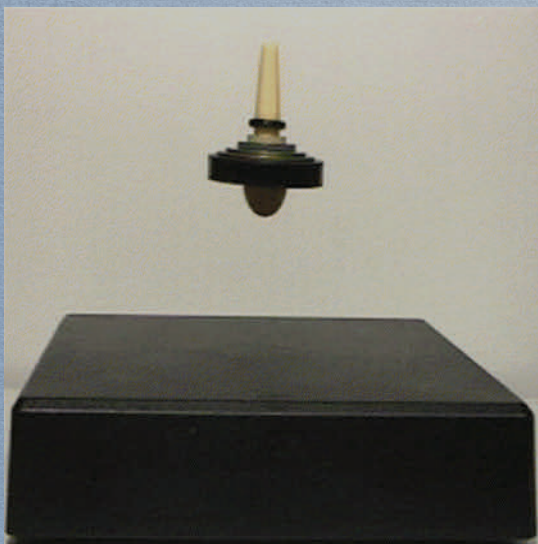
Direct Diamagnetic Levitation – How it Works

Diamagnetic materials repel a magnetic field, All materials have diamagnetic properties, but the effect is very weak, and usually overcome by the object's paramagnetic or ferromagnetic properties, which act in the opposite manner. By surrounding a diamagnetic material with a magnetic field, it can be held in a stationary position (the magnetic force is strong enough to counteract gravity).

Rotational Magnetism : Also known as spin stabilized magnetic levitation. Happens when the forces acting on the levitating object- gravitational, magnetic, and gyroscopic- are in equilibrium. Earnshaw's theorem says it is impossible.

Super Levitron : Two opposing neodymium-iron-boron permanent magnets. Original invention by Roy Harrigan and patented in 1983. He didn't known about Earnshaw's theorem which many thought said such an invention was impossible. The rotation of a spinning object's axis of spin creates a toroid of genuine stability in a way that does not violate Earnshaw's theorem, but that went completely unpredicted by physicists for more than a century. The top remain levitating in a central point in space above the base where the forces acting on the top- gravitational, magnetic, and gyroscopic- are in equilibrium. Stops due to air resistance.
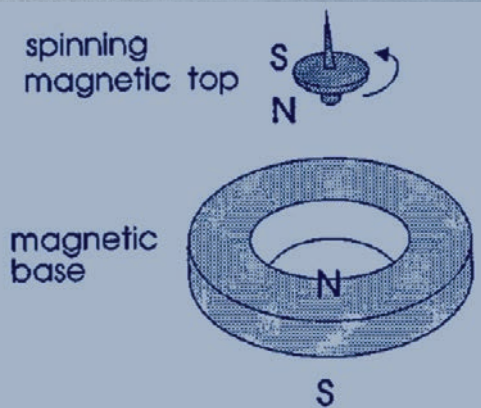
"The principle is that two similar poles (e.g., two North's) repel, and two different poles attract, with forces that are stronger when the poles are closer. There are four magnetic forces on the top: on its north pole, repulsion from the base's north and attraction from the base's south, and on its south pole, attraction from the base's north and repulsion from the base's south. Because of the way the forces depend on distance, the north-north repulsion dominates, and the top is magnetically repelled. It hangs where this upward repulsion balances the downward force of gravity, that is, at the point of equilibrium where the total force is zero."

How to get it to Work

§ Correct magnetic strengths, Mass of the top must be right within .5%
§ Magnets are temperature dependent, weaker in warmer temperatures
§ Correct spinning rate (not too fast or slow).
§ Must be introduced onto a small stabile region only millimeters wide and high.

Pukeshwar Harmukh
M. Sc. 1st Semester

REALITY OF FEAR

You're not scared of the dark,
You're scared of what's in it.

You're not afraid of heights,
You're afraid of falling.

You're not afraid of the people around you,
You're just afraid of the rejection.

You're not afraid to love,
You're just afraid of not being loved back.

You're not afraid to let go,
You're just afraid to accept the reality that it is gone.

You're not afraid to try again,
You're just afraid of getting hurt for the same reason.

NIYATI AGRAWAL
M.Tech 1st Semester

MAGLEV TRAIN

What is Maglev Train?

In some ways trains can fly. Mag- Magnetic , Lev- (Levitation- "Rising into the air") floats 1 cm above the track.

Maglev- An electric train that magnetically levitates over a track and can travel at high speeds. Magnetic levitation transport, or maglev, is a form of transportation that suspends, guides and propels vehicles via electromagnetic force. This method can be faster than wheeled mass transit systems, potentially reaching velocities comparable to turboprop and jet aircraft (500 to 580 km/h).

Magnet

Superconductor

History : In the 1960s in Britain Eric Laithwaite developed a functional maglev train. His maglev had 1.6 km of track and was in detail tested. His research was stopped in 1973 because lack of money and his progress was not enough. In the 1970s, Germany and Japan also began research and after some failures both nations developed mature technologies in the 1990's.

Superconductivity : An element, inter-metallic alloy, or compound that will conduct electricity without resistance below a certain temperature, magnetic field, and applied current.

Discovery of Meissner Effect : Standard test – proof for a superconductor, Repulsion of external magnets - levitation.

Superconductors may be considered perfect diamagnets ($\mu r = 0$), completely expelling magnetic fields due to the Meissner effect. The levitation of the magnet is stabilized due to flux pinning within the superconductor. This principle is exploited by EDS (electrodynamic suspension) magnetic levitation trains. In trains where the weight of the large electromagnet is a major design issue (a very strong magnetic field is required to levitate a massive train) superconductors are used for the electromagnet, since they can produce a stronger magnetic field for the same weight.

Construction of Maglev Train : System consist of 4 major components
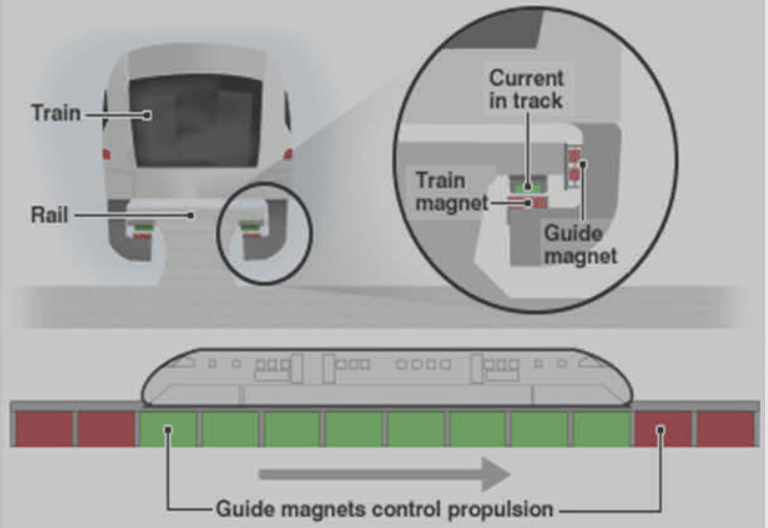Guide Way , Vehicle, Power supply, Track
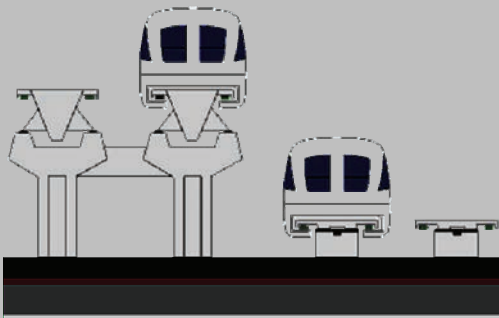
Guide Way : The guide way guides the direction of the train's movement and bears the load of the train. The superstructure of the guide way comprises precisely welded steel or reinforced concrete guide way beams for connecting long stators and substructure constituted by the reinforced concrete piers and foundations.

**Vehicle** : Vehicle is the most important part of high speed maglev system comprising levitation chassis and the magnets mounted on the chassis, secondary suspension system and vehicle section. Besides it includes such electrical appliances as on-board batteries, emergency breaking system and levitation control system.

Power Supply : Power supply includes substations, track side feeder cables switch stations and other power supply equipment.

**Track** : The track along which the train moves is called the guide way. Both the guide way as well as the train's undercarriage also have magnets which repel each other. Thus the train is said to levitate about 0.39 inches on top of the guide way. After the levitation is complete, enough power has to be produced so as to move the train through the guide way. This power is given to the coils within the guide way, which in turn produces magnetic fields, which pulls and pushes the train
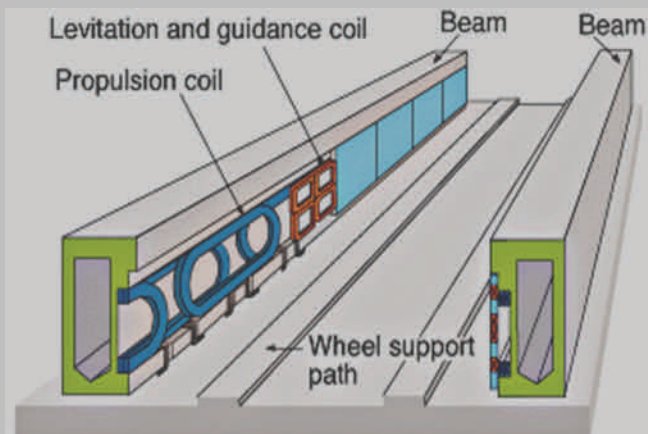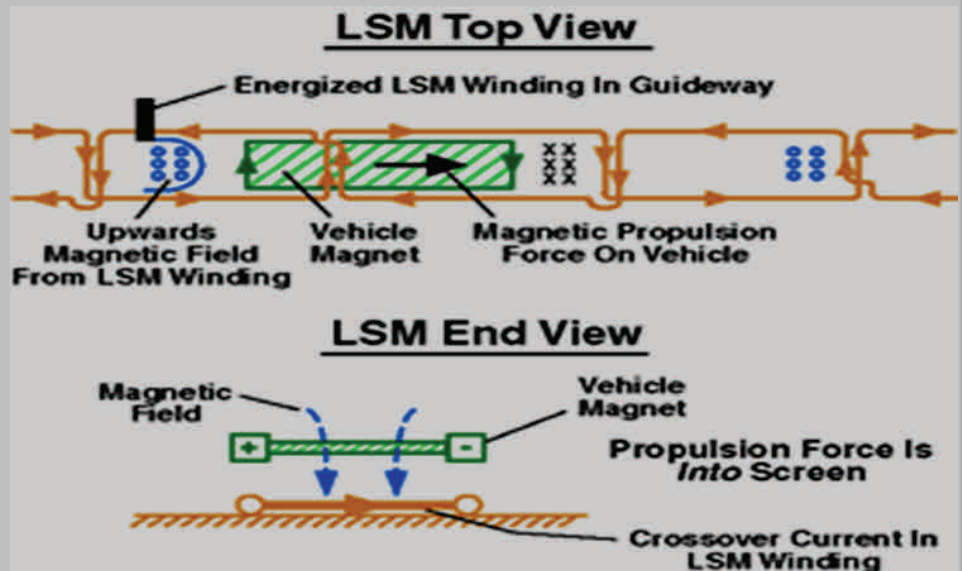

through the guide way.

Support System : The electromagnets on the underside of the train pull it up to the ferromagnetic stators on the track and levitate the train. The magnets on the side keep the train from moving from side to side. A computer changes the amount of current to keep the train 1 cm from
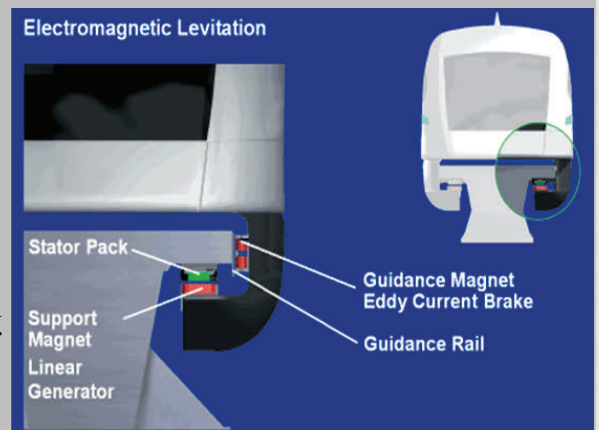
the track.

Propulsion System :

No connection with track. Linear Synchronous Motor used. AC current in windings in the guide way. Speed in controlled by frequency of the AC power. High efficiency because only the section of track that the train is on needs current.

LSM Top View

Energized LSM Winding In Guideway

Upwards Magnetic Field From LSM Winding

Vehicle Magnet

Magnetic Propulsion Force On Vehicle

LSM End View

Magnetic Field

Vehicle Magnet

Propulsion Force Is *Into* Screen

Crossover Current In LSM Winding

Advantages :

* The German Transrapid is about 20 times safer hen airplanes
* 250 times safer than conventional
* Speeds up to 500 km/h.
* 700 times safer than automobile travel
* A accident between two maglev trains is nearly impossible because the linear induction motors prevent trains running in opposite directions.
* The Maglev train doesn't contaminate a lot.
* It doesn't need any kind of fuel.
* It doesn't send out any CO_2.

GIRISH Harmukh
M. Sc. 1st Semester

Evaluation of characteristic parameters of laser diode and its applications

Sunandan Mandal

Email: sunandan.mandal12@gmail.com,

Introduction and Basic Principle : A forward biased p-n junction powered by injected electrical current. When a p-n junction is forward-biased by applying an external voltage, the built in electric field is reduced, making possible a further diffusion of electrons and holes across the junction (i.e. flat band condition).

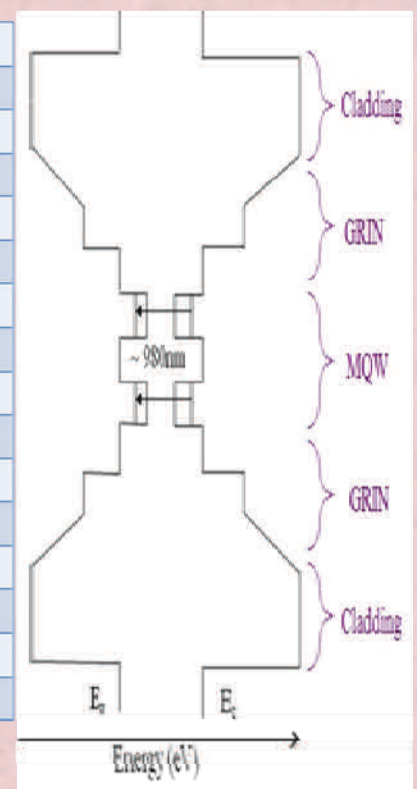Lasing and inversion condition : Stimulated emission (R21) > Absorption rate (R12)
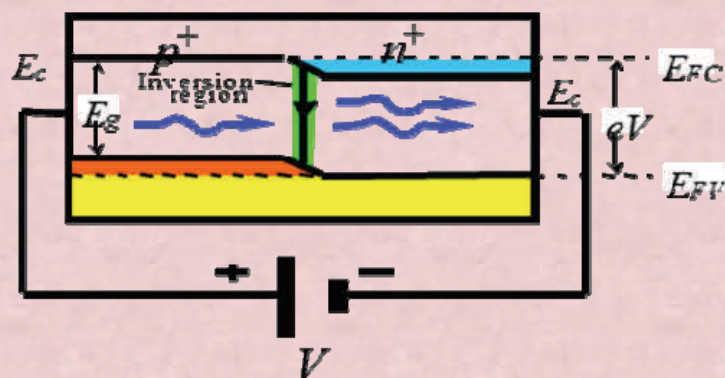
Fabrication and evaluation of characteristics parameters with different facet coating materials of laser diode emitting at 980 nm.

Several sets of laser diode structures were processed by implementing numerous device processing steps such as photolithography, multilayer of metal coatings, annealing, fabrication of mesa structure, SiO2 coating etc. Single element and arrays of laser diodes were die bonded using Indium and Au-Sn pre-form on Au coated Kovar sheet, Au coated copper sheet and also on the laser diode packages.

Epitaxial Structure of Diode Laser
p+ GaAs contact, 200nm, 2×10^{19} cm^{-3}
p-AlGaAs clad, 1200nm, 8×10^{17} cm^{-3}
p-AlGaAs clad 300nm, 5×10^{17} cm^{-3}
GRIN-AlGaAs, 10nm
AlGaAs waveguide, 100nm
GaAs barrier 10nm
InGaAs QW, 8nm
GaAs barrier 10nm
InGaAs QW, 8nm
GaAs barrier 10nm
AlGaAs waveguide, 100nm
GRIN-AlGaAs, 10nm
n-AlGaAs clad 300nm, 5×10^{17} cm^{-3}
n-AlGaAs clad, 1200nm, 8×10^{17} cm^{-3}
n-GaAs buffer, 200nm, 1×10^{18} cm^{-3}
n+-GaAs substrate(001), 1×10^{18} cm^{-3}

The dielectric coatings on laser diode facets were used for passivation in order to increase the output power and the life-time. Several materials are used for facet coatings such as Al_2O_3, TiO_2, ZrO_2 and SiO_2. Among them it is observed that a single layer of ZrO_2

and five pairs of ZrO_2/SiO_2 multilayer used for antireflection and high-reflection facet coatings show ~ 48% increased output power compared to without coated device under pulsed operation; subsequently diode was operated up to ~745mW power in CW mode. Lasing action delivering total integrated pulsed output power of ~7.4W at the injection current of 3A, pulse width 100 ns with 2 kHz repletion rate was achieved from the facet coated and die bonded array. The packaged laser diode was operated under CW up to a power of 100 mW at ~ 0.5A and used for photoluminescence (PL) measurements. In PL, the laser beam was focused using a triplet lens. Subsequently, the electronic transitions of InAsP/InP quantum well (QW) structures for two different QW thicknesses were recorded using the semi- packaged laser diode and the position of these electronic transitions are matching with those recorded using commercial lasers. In conclusion, the indigenously developed semi packaged laser diode devices are useful for spectroscopic applications.

Applications of Laser Diodes

Pumping of Solid-state lasers, Material processing, Telecommunications.
Bio-Medical Application; like Incision of skin during surgery, tissue fusion, dermatology, shaping, photodynamic therapy, tissue vaporization
In Optical Fiber Communication as a pumping source in Amplifier

Conclusion and Scope for Future

Single layer of ZrO_2 and five pairs of ZrO_2/SiO_2 multilayer used for antireflection and high-reflection facet coatings show ~ 48% increased output power compared to without coated device under pulsed operation; subsequently diode was operated upto ~745mW power in CW mode.

Lasing action delivering total integrated pulsed output power of ~7.4W at the injection current of 3A, pulse width 100 ns with 2 kHz repetition rate was achieved from the facet coated and die bonded array.

Packaged laser diode was operated under CW up to a power of 100 mW at ~ 0.5A and used for photoluminescence (PL) measurements and developed semi packaged laser diode devices are useful for spectroscopic applications
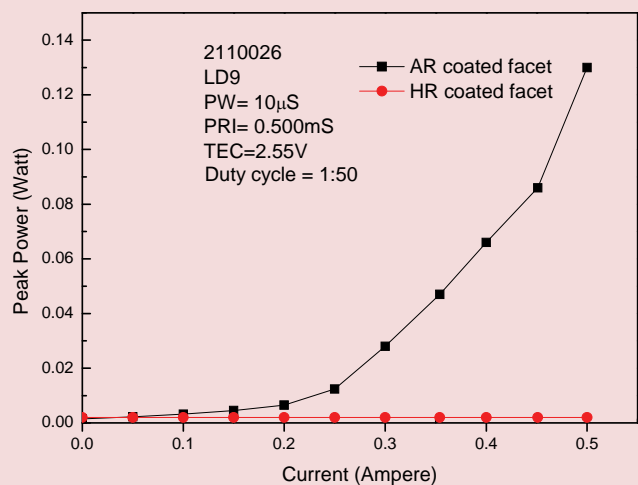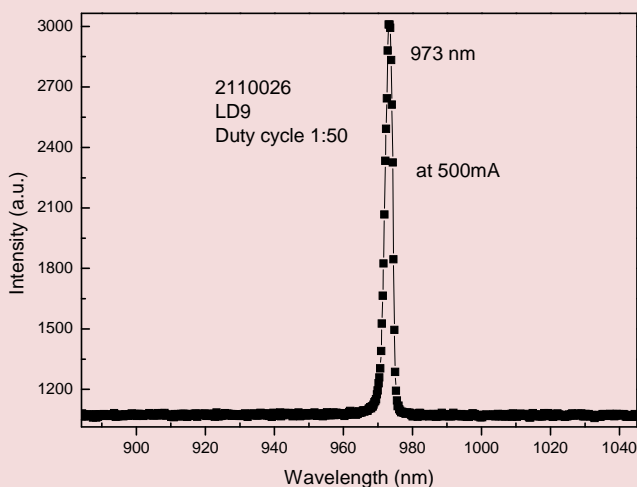
PHOTOLUMINESCENCE STUDIES ON DOPED Sr_2SiO_4 PHOSPHOR MATERIAL:
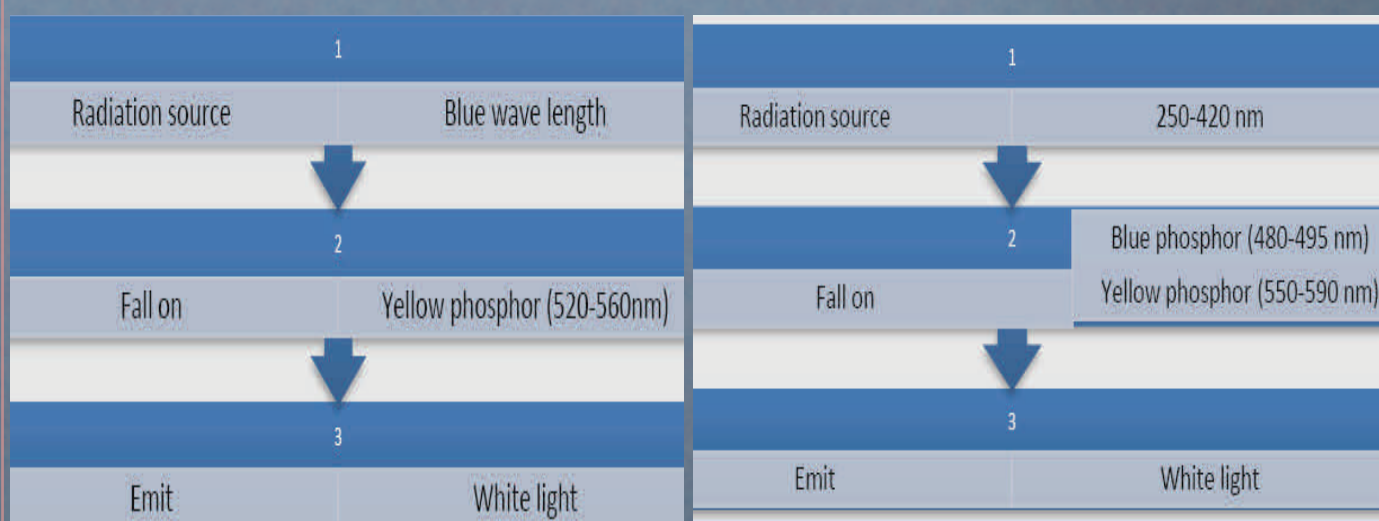## A study on phosphors for white light emission

KHEMCHAND SAHU

For white LED we need a phosphor material which emits light in blue as well as in yellow region. In three ways we can achieve white light:

i.   A blue LED with yellow light emitting phosphor emits white light.
ii.   A LED (370 - 405nm) with blue light emitting phosphor physically mixed with and yellow-red light emitting phosphor emits white light.
iii. A LED (370 - 405nm) with a compound having both blue and yellow emission characteristic emits white light.

Generally the blue phosphor should have broad emission in 480-510 nm and the yellow phosphor should have broad emission in 570 - 620 nm range. We have chosen Sr_2SiO_4 as a host phosphor material because it is highly stable to temperature and emission of different wavelengths in visible region using suitable rare earth doping. This is promising host material due to its high melting point and low phonon energy. They are used in plasma display panels, field emission displays, cathode ray tubes.

The Ce: Sr_2SiO_4 and Eu: Sr_2SiO_4 powders were prepared using solid state reaction route. All the powders doped in different stoichiometric ratios were calcined at 1100°C and characterized by XRD for phase confirmation. The excitation and emission spectra were recorded using photoluminescence spectrometer at different excitation wavelengths.
The Sr_2SiO_4 is doped with Ce showing emission peak ranging in wavelength from 400 to 500nm in blue green region. The Sr_2SiO_4 is doped with Eu showing an intense emission in wavelength ranging from 600 to 620nm. Different combinations of these materials can be used for white light emission.

1	
Radiation source	Blue wave length

↓

2	
Fall on	Yellow phosphor (520-560nm)

↓

3	
Emit	White light

1	
Radiation source	250-420 nm

↓

2	Blue phosphor (480-495 nm)
Fall on	Yellow phosphor (550-590 nm)

↓

3	
Emit	White light

EVETNS & CULTURAL ACTIVITIES

SCHOOL OF STUDIES IN
ELECTRNOICS & PHOTONICS

WAY TO
POLLING BOOTH
SOS STUDENT ELECTION
Pt. RAVISHANKAR SHUKLA UNIVERSITY,RAIPUR
01- A M.Sc. ELECTRONICS
01-B M.TECH.IN OPTO & LASER TECH.

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ROOM NO 1
SOS STUDENT ELECTION 2014

SOS STUDENT ELECTION 2014
TIME 08:00 TO 12:00 AM

POLLING BOOTH
STUDENT UNION ELECTION
2014-15
Pt. RAVISHANKAR SHUKLA UNIVERSITY,RAIPUR
(01-A) M.Sc. FIRST SEMESTER ELECTRONICS 2014
(01-B) M.TECH. FIRST SEMESTER OPTO ELECTRONICS
& LASER TECH.2014

STUDENTS WELCOME PARTY

LECTURE ON RESEACH METHODGY
BY Dr: MOHAMMED IMTIAZ AHMED

EDUCATIONAL VISIT AT OUR INSTITUTE

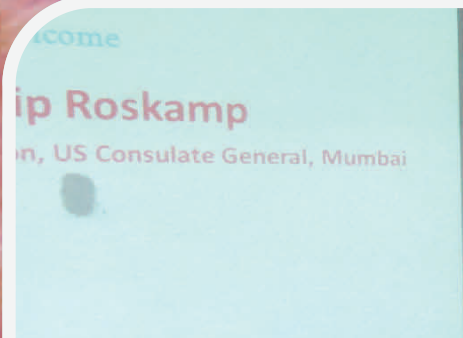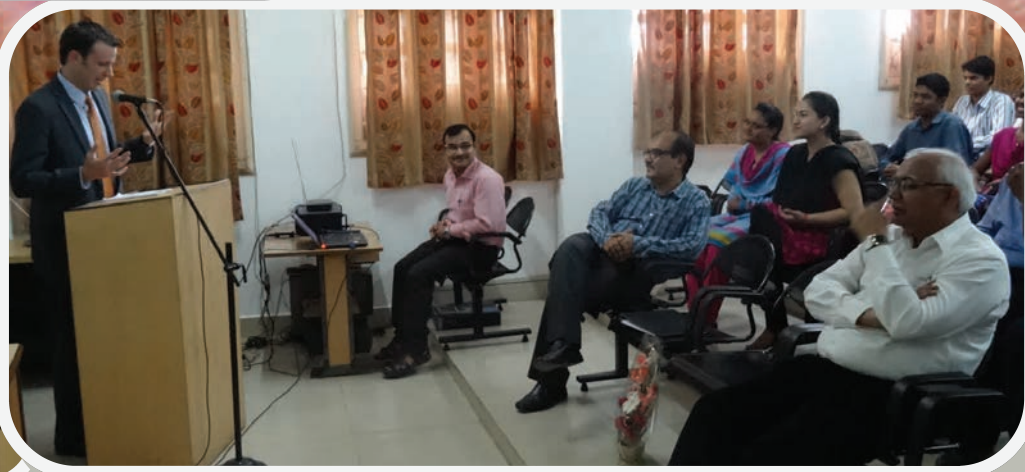LECTURE ON HIGHER STUDIES IN USA
Mr. PHILIP ROSKAMP

Quotes of Life
A to Z of Motivation

Anshu Singh Thakur

Avoid Negative Thoughts, People, Things and Habits.

Believe in yourself.

Consider things from every angle and others points of view.

Dare to Dream and Dream Big

Energy, Excitement and Enthusiasm is in your blood.

Family and Friends are hidden treasures; enjoy these riches.

Give more than you planned to.

Have a good sense of humour.

Ignore Criticism, Ridicule and Discouragement from others.

Jump on Problems because they are Opportunities in disguise.

Keep up the good work however hard it may seem.

Love yourself, just as you are.

Make Impossibility a Possibility.

Never lie, cheat or steal, always strike a fair deal...

Open your eyes and see things as they really are.

Prefect Practice makes you perfect.

Quitters never Win and Winners never Quit.

Reward yourself for every small success and achievement.

Stop Wasting your Time and Procrastinating important Goals.

Take control of your Life and your Goals.

Understand so that you could be Understood.

Visualize your Goals and Dreams everyday.

Win over your own weaknesses and make them as your Strengths.

Xccelerate your efforts

Yes Yes Yes, Yes you Can and You Will

Zap your Stress and Enjoy your Life..

OUR DEPARTMENT GEMS

Sketched by Niharika Kolhekar
M. Tech 1st Semester

"If you want to find the secrets of the universe, think in terms of energy, frequency and vibration (not matter)" - Nikola Tesla