

Vivek Kumar Shukla

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Dr. Vivek Kumar Shukla is an Experimental Condensed Matter physicist, whose chief interest lies in Thin film properties, and physics and engineering of Electronic and Photonic Materials suitable for device applications. Apart from Large Area Electronics applications such as solar cells and display devices, he has interest in Nano scale engineering of soft materials.

He obtained his doctoral degree on *Thin film and Opto-electronic properties of Organic Semiconductors* (applied in devices like Organic light emitting diodes, OLEDs and organic solar cells, OSCs) at the I.I.T. Kanpur working under supervision of *Professor Satyendra Kumar* in year 2006. Subsequently, he carried out his postdoctoral research (The Abdus Salam ICTP-TRIL, UNESCO) at ISMN-CNR Bologna, Italy and obtained about two years of experience. Later, he gained about one year of industrial (R&D) experience on OLED technology based mobile screen size display fabrication at SAMTEL R&D center before joining GBU in April 2010.

Regarding teaching, apart from core courses, he is interested to offer elective courses on Electronic and Photonic materials for device applications, Thin Films technology and on Renewable energy.

Awards and Recognitions

- **The Abdus Salam ICTP-TRIL (UNESCO) Postdoctoral Fellowship** (Jan 2007- Jan 2009) at ISMN-CNR, Bologna, Italy.
- **Recipient of cash award** (Rs 20,000/-) from IIT Kanpur for publication in journals listed in ISI web of science (2006, two times).
- **Travel grant** from SAMTEL Color Ltd., SUKRITI Vidyut Pvt. Ltd, Ghaziabad and IIT Kanpur to participate in *ICMAT-2003* and *ICMAT-2005* at Singapore.
- Qualified **NET (National Eligibility Test)** for Lecturer ship (1999).
- Qualified **GATE** (Graduate Aptitude Test in Engineering) examination conducted by Indian Institute of Technology, IITs (1999).
- **Gold Medal** for securing highest marks in M.Sc. (PPN College), CSJM University, Kanpur (1998).
- Recipient of **National Merit Scholarship** of government of India (1991-1996).

Employment (Particulars of past positions)

Position	Organization	Duration	Duties
Assistant Manager (R&D) OLED group	SAMTEL Color Limited, Ghaziabad (deputed at IIT Kanpur)	March 2009 – April 2010	Mobile screen size display fabrication and engineering (OLED based)
Senior Project Scientist	IIT Kanpur	Dec 2008-March 2009	Characterization of MgO thin films
Postdoctoral Fellow The Abdus Salam ICTP-TRIL (UNESCO)	ISMN-CNR, Bologna, Italy	Jan 2007 - Oct 2008	OLEC fabrication and characterization

Professional Training Received

Year	Nature of Training	Duration	Organization where training was provided
2005	Short Term Course on Organic Semiconductors	One week course, organized twice in a year (2005, 2006)	SCDT (Samtel Center for Display Technologies) at IIT Kanpur, India

Teaching Experience:

S. N.	Course taught	Details
1	Undergraduate Physics lab (PHY 101)	1999-2004 (Instructed with other colleagues), IITK

Industrial Experience/Interaction:

Organization	Nature of work	Period
SAMTEL Color Limited, R&D centre (SCDT) at IIT Kanpur	Mobile screen size commercial Display (OLED based) fabrication and engineering (Company position, as a Team member- OLED group)	March 2009- Till date
SCDT (SAMTEL Centre for Display Technologies), R&D centre at IIT Kanpur	Alq3 thin film properties and OLED fabrication (SAMTEL project)	2002-2006 (about 5 years, Concurrently with PhD)

Short term courses / Workshops / Seminars etc. Organized

1. Indo-Italian workshop on organic semiconductors, IIT Kanpur (member, organizing body)
2. Asian Society for Information Display, ASID 2005, New Delhi (member, organizing body)
3. Short Term Course on Organic Semiconductors, 2005-2006, SCDT, IIT Kanpur
(member, organizing body)

Technical and characterization skills

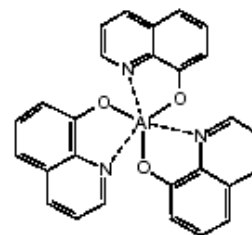
- **Mobile screen size commercial display fabrication** (OLED based) using **DOOSAN** make fabrication unit
- **Organic device simulation** using **SILVACO** software
- **Organic device fabrication (Clean room environment class 1000)**
- Photolithography technique for patterning ITO coated substrates
- Oxygen Plasma Treatment
- Glove box operation in Nitrogen atmosphere
- Kelvin Probe Method for work function measurements of metals
- High vacuum operations (10^{-7} mbar)
- Electroluminescence (EL) measurements (by Minolta and Avaspec)
- I-V, I-time (Keithley), Luminescence-time measurements (Photo Multiplier Tube)
- Thin film formation by physical vapor deposition (small molecules) and by spin coating (polymers)
- Profilometry (Thickness, Roughness measurement, *Alphastep*)
- **Spectroscopic Ellipsometry** (Phase Modulated Spectroscopic Ellipsometer, *Jobin Yvon*) simulation and fitting using Amorphous Model for determination of optical constants (refractive index, absorption)
- **Atomic Force Microscopy (AFM)** study for thin film morphology
- Optical Microscopy (Leica)
- UV-Vis absorption measurements
- **Photoluminescence measurements;** Transient (IBH) and Steady state (JobinYvon)
- PL Quantum Efficiency measurement
- Familiar with X-Ray Diffraction analysis and Infrared (IR) spectroscopy
- Familiar with NMR Spectroscopy and ESR Spectroscopy
- Design and construction of Helium cryostats
- Handling of low temperature (liquid Helium temperature) measurements systems for electrical and magnetic characterization of thin films and bulk materials.
- **Synthesis** of organic semiconducting materials (small molecules like Alq₃)

Computer Skills: Softwares: MS-Office,
Origin;
SILVACO, for Organic semiconducting device simulation.

Operating Systems: Linux, Windows

Research work (Experience)

1. To have a better understanding of organic materials, I learned to **Synthesize** the organic semiconductor (small molecules) like Alq₃, Znq₂, Inq₃ (green light emitting materials), Zn(BOX)₂ (a blue emitter) and characterized the synthesized material using DSC, PL, CHNS-O analysis, FTIR and NMR.



2. **Thin film deposition** of small molecules by thermal evaporation and by spin coating in case of polymers (like PPV).

3. **Optical characterization** of these thin films by Photoluminescence (PL), Time resolved PL, UV-Vis Spectroscopy and Spectroscopic Ellipsometry (Optical constant were determined using Amorphous Foroughi-Bloomer model).

4. **Morphological studies** on deposited films at different deposition conditions (different rates and substrate temperatures) and changes on annealing in different ambient (degradation study) are studied by atomic force microscope (AFM, Molecular Imaging).

5. **Effect of deposition conditions** (substrate temperature and deposition rate) on morphology and optical properties of thin films has been studied using PL, Lifetime, SE and AFM.

6. **Degradation study**: Light and environmental (humidity, oxygen, nitrogen, temperature) induced effects on optical properties of thin films are studied systemically.

7. **A stable blue emitting Zinc- quinolate complex** was formed in thin film form from a green emitter (Znq₂) exploiting the degradation mechanism, which may have application in fabrication of blue OLED.

8. **Organic device fabrication** in multiple layers (OLEDs) and single layer structure (OLECs)

9. **Light emitting device characterization** by I-V, Electroluminescence (EL), and Radiometry / Photometry measurements.

10. **PL Lifetime study** on operated organic light emitting electrochemical cells (OLECs) based on Iridium complex as an active layer to understand the degradation mechanism of OLECs.

11. **Effect of counterions and ligands** in device performance of Ir-complex based organic light emitting electrochemical cells.

12. Fabrication of mobile screen size Display.

(Images captured on 1" and 1.5" mobile screen size display fabricated by us at SAMTEL, IITK)



13. Organic device **simulation** using **SILVACO** software.

Selected Conferences/Seminars where participated

Year	Conferences/Seminars attended	Title of paper read
2003	Indo-Italian workshop on organic semiconductors, IIT Kanpur, India	Environmental and light induced effects on 8-hydroxyquinoline derivative metal complex small molecules
2003	2 nd International Conference on Materials for Advanced Technologies, ICMAT & IUMRS–International Conference in Asia 2003, Singapore.	Ellipsometric investigations on the light induced effects on tris (8-hydroxyquinoline) Aluminium (Alq ₃)
2004	7 th International conference on optoelectronics, fiber optics & photonics, (Photonics-2004), Kerala, India	Optical studies on environmental and light induced effects on 8-hydroxyquinoline derivative metal complex small molecular thin films
2005	3 rd International Conference on Materials for Advanced Technologies (ICMAT) & International union of material research societies (IUMRS), 9 th International Conference on Advance Materials (ICAM), ICMAT-2005, IUMRS-ICAM 2005, Singapore.	AFM studies on formation of new phase Responsible for enhanced photoluminescence in a light emitting small molecular thin film and Light induced effects on photoluminescence and optical constants of Inq ₃ thin film used in organic light emitting devices
2005	Thirteenth International Workshop on Physics of Semiconductor Devices (IWPSD), New Delhi	Blue shift in photoluminescence peak position on tris (8-hydroxyquinoline)metal complex thin films used as emitting layer in organic light emitting devices
2006	The 9 th Asian Symposium on Information display, ASID New Delhi, India	Study of optical properties and light induced effects on Inq ₃ thin film used in organic light emitting devices
2007	FIRB-2007 , November-07, Milan, Italy	Organic Light-emitting Electrochemical Cells (OLECs) based on a cataionic organometallic Iridium complex
2008	Photonics Europe-2008 , Strasbourg, France	Interesting luminescent properties of a new cyclometallated Ir(III) complex and the prototype of the related electroluminescence device

SELECTED PUBLICATIONS

Papers in refereed journals:

- [1] *Application of Spectroscopic Ellipsometry to probe the environmental and photo-oxidative degradation of PPV*, **Synthetic Metals** **139** (2003) **751**.
- [2] *Ellipsometric investigations on the light induced effects on tris (8-hydroxyquinoline) Aluminium (Alq₃)*, **Thin Solid Films** **477** (2005) **240**.
- [3] *Light Induced Effects on the Morphology and Optical Properties of 8-hydroxyquinoline Aluminium (Alq₃) Small Molecular Thin Films*, **Synthetic Metals** **156** (2006) **387**.
- [4] *AFM Studies on Formation of New Phase Responsible for Enhanced Photoluminescence in a Light Emitting Small Molecular Thin Film*, **Journal of Luminescence** **121** (2006) **132**.
- [5] *Light induced effects on photoluminescence and optical constants of Inq₃ thin film used in organic light emitting devices*, **Optical Materials**, **29** **12** (2007) **1809**.
- [6] *Investigations of environmental induced effects on Alq₃ thin films by phase imaging*, **Applied Surface Science**, **253** **16** (2007) **6848**.
- [7] *Excimer emission in single layer electroluminescent devices based on [Ir(4,5 diphenyl-2-methyl-thiazolo)2(5-methyl-1,10-phenanthroline)]+[PF₆]-*, **J. Phys. Chem. C**, **113** (2009) **12517**.
- [8] *Conversion of a green light emitting Zinc-quinolate complex thin film to a stable and highly packed blue emitter*, **Synthetic Metals**, **160** (2010) **450**.
- [9] *Structural, Optical and Morphological studies on green light emitting Zinc-quinolate complex used in OLED*, (Under preparation)

Papers in conference Proceedings:

- [1] *Optical studies on environmental and light induced effects on 8-hydroxyquinoline derivative metal complex small molecular thin films*, presented in 7th International conference on optoelectronics, fiber optics & photonics, Kerala, **India. Photonics-2004, India, Proceedings**, p.439.

[2] *AFM Studies on Formation of New Phase Responsible for Enhanced Photoluminescence in a Light Emitting Small Molecular Thin Film and*

[3] *Light induced effects on photoluminescence and optical constants of Inq₃ thin film used in organic light emitting devices* presented in 3rd International Conference on Materials for Advanced Technologies (ICMAT) & International union of material research societies (IUMRS), 9th International Conference on Advance Materials (ICAM), **ICMAT-2005, IUMRS-ICAM 2005, Singapore. Proceedings, p.56.**

[4] *Influence of substrate temperature on morphology and optical properties of Alq₃*, 50th Annual **DAE** Solid State Physics Symposium (December 5–9, 2005) Bhabha Atomic Research Centre, Mumbai, **India**, Proceedings, **p.419**

[5] *Blue shift in photoluminescence peak position on tris (8-hydroxyquinoline)metal complex thin films used as emitting layer in organic light emitting devices*, Thirteenth International Workshop on Physics of Semiconductor Devices (**IWPSD**), New Delhi, Dec. 2005, in Physics of Semiconductor Devices, Vol I, Eds. V. Kumar and P.K. Basu, (Allied, N.Delhi) **(2005) p.211.**

[6] *Study of optical properties and light induced effects on Inq₃ thin film used in organic light emitting devices*, The 9th Asian Symposium on Information display, October 2006, New Delhi, India, **ASID'06 Proceedings, p.248.**

[7] *Optical properties of Electroluminescent Zinc(II) bis(8-hydroxyquinoline) thin films prepared at different deposition rates*, p.206. The 9th Asian Symposium on Information display, October 2006, New Delhi, India, **ASID'06 Proceedings.**

ADDITIONAL REMARKS / INFORMATION

Extra Curricular activities

- **Assistant coordinator**, Counseling Service, IIT Kanpur, 2002-2003.
- **Election Officer**, Students Gymkhana Elections, IIT Kanpur, 2002.
- **Member**, Senate Post Graduate Committee, (SPGC), IIT Kanpur, 2001-2002.
- **Student guide**, Counseling Service IIT Kanpur 2001-2002.
- National Cadet Corps, **NCC 'C' certificate**, 1996.