

# CURRICULUM VITAE

**KARTHIKA S**

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**Age and Date of Birth:** 31 Years, 25<sup>th</sup> May 1984

**Sex :** Female

**Marital Status :** Married

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**Academic Qualifications**

**Ph.D** Awarded on 28-2-2015

**Ph.D. Area of work :** Fabrication and characterization of Hybrid Photonic materials

**Title of the Thesis:** Synthesis and characterization of Titania-Zirconia Based Nano-Composites

**Research Experience :** Five Years

**Institution :** School of Pure & Applied Physics

**University :** Mahatma Gandhi University  
**Research Guide :** **Dr. N. V. Unnikrishnan**, Professor,  
School of Pure & Applied Physics

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**M.Phil (physics)** Bharathiar university, Coimbatore

Year of Passing : 2008

Percentage of Marks Obtained : 58

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**BE.d (Physics)** Kerala University, Trivandrum

Year of Passing : 2007

Percentage of Marks Obtained : 66

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**M. Sc. (Physics)** Mahatma Gandhi University, Kottayam

Year of Passing : 2006

Percentage of Marks Obtained : 79.1

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**B. Sc. (Physics)** University of Kerala, Trivandrum.

Year of Passing : 2004

Percentage of Marks Obtained : 71.4

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**Pre Degree** Mahatma Gandhi University, Kottayam.

Year of Passing : 2001

Percentage of Marks Obtained : 59

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**S.S.L.C** Board of Public Examinations, Kerala State.

Year of Passing : 1999

Percentage of Marks Obtained : 84.5

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## Research Works done

The Titania- Zirconia xerogels with three different ratios were prepared by the new sol-gel route. The matrix was characterized by using FT-IR, TGA-DTA and XRD. The FT-IR spectra reveal the formation of Zr-O-Ti bridges by its characteristic vibration in 663cm<sup>-1</sup>. The crystallization of titania and zirconium titanate varies with the Ti/Zr molar ratios. The

DTA analysis agrees with this crystallization process and TGA analysis shows the corresponding weight loss. Semiconductor cadmium sulphide doped in this matrix. The TEM measurements confirmed the presence of CdS nanocrystallites. The optical band gap and size of the CdS nanocrystallites are calculated from the absorption spectrum. The size also calculated from the TEM measurements. The measurements yielded the size of the nanocrystallites to be around 8nm and the crystal inter planar spacing to be  $3.533 \text{ \AA}$ , which match the (1 0 0) plane of bulk CdS. CdS/ $\text{Sm}^{3+}$  and CdS/ $\text{Tb}^{3+}$  doped Titania-Zirconia xerogels are also prepared. The absorption, excitation and fluorescence features of samples are briefly discussed. The fluorescence spectra reveal that the intensity of characteristic emission of samarium and terbium increases considerably in the presence of CdS nanocrystallites.

Cadmium selenide semiconductor nanocrystals along with samarium ions and terbium ions were also incorporated in Titania-Zirconia xerogels through sol-gel route. The alone doped samples was also prepared for further studies. Thermal stability of the matrix was analysed by the thermogravimetric studies. The FT-IR spectrum reveals the different vibrational modes present in the sample. The electron diffraction and TEM measurements have yielded the values of crystal plane spacing and the crystallite size. The absorption spectrum confirms the formation of cadmium selenide nanoparticles. The fluorescence intensities were compared for  $\text{Sm}^{3+}$  and  $\text{Sm}^{3+}/\text{CdSe}$  doped  $\text{TiO}_2\text{-ZrO}_2$  matrices. Similarly the fluorescence intensities were also compared for  $\text{Tb}^{3+}$  and  $\text{Tb}^{3+}/\text{CdSe}$  doped Titania-Zirconia matrices. The fluorescence intensities of the samarium ions and terbium ions are found to be greatly enhanced by codoping with CdSe nanoparticles.

Again the  $\text{Eu}^{3+}$ ,  $\text{Eu}^{3+}/\text{CdS}$ ,  $\text{Eu}^{3+}/\text{CdSe}$  doped Titania-Zirconia matrix were prepared. Nonradiative decay rate due to the multiphonon relaxation process was calculated by the Miyakawa-Dexter theory. The vibrational state side band analysis provide information about the coupling between vibrational modes and electronic transitions. The vibrational state side bands measurements also gives the values of vibrational state maxima and electron vibrational state coupling strength. From the emission spectrum intensities of electric dipole transitions with respect to magnetic dipole transition gives a measure of the distortion from the inversion symmetry at the  $\text{Eu}^{3+}$  site. The vibrational state side band lines and Raman data shows a close relationship between the vibrational state side band maxima and the vibrational modes. The FTIR spectrum shows strong bands inside the

sample. The TGA curve also shows the corresponding weight loss of the sample. Terbium ions codoped with  $\text{Eu}^{3+}/\text{CdS}$  and  $\text{Eu}^{3+}/\text{CdSe}$  doped samples RGB emission is observed. The emission spectrum for the sample has been converted to the CIE 1931 color coordinate system. The color coordinates are determined and white light emission is observed from this. The various concentrations of  $\text{Sm}^{3+}$  ions doped Titania-Zirconia matrices will be prepared. From the absorption spectra J-O parameters and different radiative parameters like radiative transition probability, total radiative transition probability, branching ratio and lifetime are analysed using Judd-O-felt theory. The already prepared  $\text{Sm}^{3+}/\text{CdS}/\text{CdSe}$  doped Titania-Zirconia matrices will also analysed by the JO theory.

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### **Research Papers Published/Communicated**

1. **Karthika S**, Sajana M.S, Sunil Thomas, K.P. Revathy, P.R. Biju Unnikrishnan N.V, Structural and Optical studies of  $\text{Eu}^{3+}$ /nanocrystallites doped titania-zirconia hybrids, *J. Alloys and Comp.* 615(2014)188-193.
2. **Karthika S**, Prathibha Vasudevan, Ann Mary K.A, Viji Vidyadharan, Biju P.R, Unnikrishnan N.V, Structural and spectroscopic studies of  $\text{Sm}^{3+}/\text{CdS}$  nanocrystallites in sol-gel  $\text{TiO}_2\text{-ZrO}_2$  matrix, *J. Electro. Mater.* **43** (2014) 447-451.
3. **Karthika S**, Ann Mary K.A, Sunil Thomas, Cyriac Joseph, Unnikrishnan N.V, Structural and Optical studies of  $\text{Tb}^{3+}/\text{CdSe}$  nanocrystallites doped in titania- zirconia matrices, *Int. J. Semicond. Sci. Tech.* **4** (2013) 11-22.
4. **Karthika S**, Unnikrishnan N.V, Structural and Optical Characterization of  $\text{CdSe}/\text{Eu}^{3+}/\text{Tb}^{3+}$  Doped  $\text{TiO}_2\text{-ZrO}_2$  Matrices, *Knowledge of Research Section A : Physical Science A2* (2015) 63-70.
5. **Karthika S**, Unnikrishnan N.V Judd-Ofelt analysis of  $\text{Nd}^{3+}$  doped  $\text{TiO}_2\text{-ZrO}_2$  matrices, *Catholicate journal* (2015).
6. Jyothy Parvathy V, Arun Kumar K.V, **Karthika S**, Rajesh R, Unnikrishnan N.V, Dielectric and AC Conductivity Studies of  $\text{CdSe}$  nanocrystals doped sol-gel silica matrices, *J. Alloys Comp.* **493** (2010) 223.

7. RejiKumar P.R, Prathibha Vasudevan, **Karthika S**, George J, Unnikrishnan N.V, Structural and Spectroscopic Characterization of  $\text{Ho}^{3+}$  in Sol-Gel Silica, *J. Optoelectro. Adv. Mater.* **12** (2010) 1065.
  8. Jyothy P.V, Rejikumar P.R, Vinoy Thomas, **Karthika S**, Unnikrishnan N.V, Optical Characterization of  $\text{CdSe/Dy}^{3+}$  doped Silica Matrices, *PRAMANA –J. Phys.* **75** (2010) 999.
  9. Prathibha Vasudevan, **S. Karthika**, Cyriac Joseph, C. Sudarsanakumar, N.V. Unnikrishnan, Synthesis of pure anatase  $\text{TiO}_2$  nanocrystals in  $\text{SiO}_2$  host and the determination of crystal planes by Image, *J. Mater. Letts.* **65** (2010) 664.
  10. Prathibha Vasudevan, Sunil Thomas, **Karthika S**, Biju P.R, Cyriac Joseph, Unnikrishnan N.V, Fluoresence Enhancement in  $\text{Sm}^{3+}/\text{TiO}_2$  nanocrystallites doped PVP Matrix, *J. Opt.* **40** (2011) 96.
  11. Prathibha Vasudevan, Sunil Thomas, Arunkumar K V, Karthika S and Unnikrishnan N V IOP Conf. Ser.: Mater. Sci. Eng. 73 012015 doi:10.1088/1757-899X/73/1/012015.
  12. Viji Vidyadharan, Prathibha Vasudevan, S Karthika, Cyriac Joseph, NV Unnikrishnan, PR Biju, *J. Electro. Mater.* **44** (2015) 2754-2761.
  13. **Karthika S**, Prathibha Vasudevan, Viji Vidyadharan, Biju P.R, Unnikrishnan N.V, Structural and Optical Characterization of  $\text{Tb}^{3+}/\text{CdS}$  doped titania- zirconia xerogels, *J. Optoelectro. Adv. Mater.-Rapid Communication* [communicated].
  14. **Karthika S**, Sunil Thomas, Viji Vidyadharan, Biju P.R, Unnikrishnan N.V, Spectroscopic characterization of  $\text{Sm}^{3+}/\text{CdSe}$  nanocrystallites in  $\text{TiO}_2\text{-ZrO}_2$  matrices, *Mater. Sci. Poland* [Communicated].
  15. **Karthika S**, Sajana M.S, Viji Vidyadharan, Ann Mary K.A, Unnikrishnan N.V, Judd-Ofelt analysis of  $\text{Sm}^{3+}/\text{CdS}/\text{CdSe}$  nanocrystallites doped  $\text{TiO}_2\text{-ZrO}_2$  hybrid hosts, *Phys. Chem. Glasses* [Communicated].
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## **Research Papers Presented in National/International Seminars**

1. Rejikumar P.R, Prathibha Vasudevan ,**Karthika S**, Unnikrishnan N.V, Effect of Triangular and spherical silver nanoparticles on the dielectric properties of Holmium doped silica glass, *National seminar on 'Recent advances in nano science & Technology'* [ **NS NANO- 2009**], S.N College, Kollam.
2. Siby Mathew, **Karthika S**, Prathibha Vasudevan, Mathew K.T, Unnikrishnan N.V, Dielectric studies of ZnSe /  $\text{Eu}^{3+}$  ions in Sol Gel Glasses, *National workshop on 'Quantum confined systems and nanoscale devices'* [2009], St.Thomas College, Pala.
3. Jyothy P.V, Rejikumar P.R, Vinoy Thomas, **Karthika S**, Unnikrishnan N.V, Optical characterization of CdSe/ $\text{Dy}^{3+}$  doped silica matrices, *'National Laser Symposium'* [**NLS-9, 2010**], Baba Atomic research Center(BARC), Mumbai.
4. Prathibha Vasudevan, Sunil Thomas, **Karthika S**, Biju P.R, Cyriac Joseph, Unnikrishnan N.V, Fluorescence enhancement in  $\text{Sm}^{3+}/\text{TiO}_2$  nanocrystallites doped PVP matrix, XXXV Optical Society of India Symposium, *International conference on 'contemporary trends in optics and optoelectronics'* [2011], IIST, Thiruvananthapuram.
5. Prathibha Vasudevan, **Karthika S**, Sunil Thomas, Siby Mathew, Unnikrishnan N.V, Synthesis And Characterization Of Anatase  $\text{TiO}_2$  Nanoparticles By Simple Polymer Gel Technique, *National Seminar on 'Recent trends in nonlinear optical materials and characterization'* [ 2011], Sacred Heart College, Chalakudy.
6. Prathibha Vasudevan, **Karthika S**, Sunil Thomas, Biju P.R, Unnikrishnan N.V, White Light Emission From  $\text{Tb}^{3+} : \text{Eu}^{3+}$  / PVA Film Under Single UV Excitation, *National Workshop on 'Mesmerism in Opto-Electronics'* [2011], Baselius College, Kottayam.
7. Prathibha Vasudevan, Arun Kumar K.V, **Karthika S**, Sunil Thomas, Unnikrishnan N.V, Nanocrystalization Of  $\text{TiO}_2$  In PVP Matrix And Its Structural Characterizations, *Third International Conference on 'Frontiers in Nanoscience and Technology'* 'Cochin Nano [2011], Cochin.

8. **Karthika S**, Sunil Thomas, Viji Vidyadharan, Biju P.R, Unnikrishnan N.V, Structural and spectroscopic studies of  $\text{Sm}^{3+}$  / CdSe nanocrystallites in  $\text{TiO}_2$  – $\text{ZrO}_2$  matrices, *Second International Conference on 'Nanomaterials – Synthesis, Characterization & Applications'* [**ICN 2012**], Kottayam.
9. **Karthika S**, Prathibha Vasudevan, Viji Vidyadharan, Unnikrishnan N.V, Fluorescence Studies of Tryptophan in Sol-Gel Titanosilicate Xerogels, National Seminar on “Current Developments in Nano Materials” [**NANOMS 2012**], Catholicate College, Pathanamthitta.
10. Viji Vidyadharan, **Karthika S**, Ann Mary K.A, Biju P.R, Cyriac Joseph, Unnikrishnan N.V, Optical and Dielectric Studies of  $\text{Bi}^{3+}$ ,  $\text{Bi}^{3+}/\text{Sm}^{3+}$  doped Sol-Gel Silica Glasses, *National Seminar on 'Current Trends in Material Science'* [**NSCTMS 2012**], NSS Hindu College, Changanasserry.
11. Prathibha Vasudevan, Sunil Thomas, Arunkumar K.V, **Karthika S**, Unnikrishnan N.V, Synthesis and dielectric studies of poly (vinyl pyrrolidone) / titanium dioxide nanocomposites, *International conference on 'Materials Science and Technology'* [**ICMST 2012**], St. Thomas College, Pala.
12. **Karthika S**, Rani George, Sajana M.S, Cyriac Joseph, Unnikrishnan N.V, Local symmetry analysis of  $\text{Eu}^{3+}$ /nanocrystallites doped titania-zirconia hybrids, National Seminar on ‘23<sup>rd</sup> Swadeshi Science Congress’ [**2013**], Mahatma Gandhi University, Kottayam.

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## References:

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