

Curriculum Vitae

J. Krishna Murthy (Ph.D.)

Cryogenic Engineering center,
Indian Institute of Technology,
Kharagpur.

PIN: 721302.

E-mail: 09CR9701@iitkgp.ac.in, krishna.jk1@gmail.com

Phone: +919609405323



Objective:

I would like to contribute to the basic research as well as to the application part of science.

EDUCATION

- **Ph. D.** in Cryogenic Engineering Centre at Indian Institute of Technology, Kharagpur, India. 2009-2014 (Thesis submitted)

Thesis title: “**Multiferroicity, Phase separation and magnetic field driven phenomena in R_2CoMnO_6 ($R= La, Gd, Y$) and $La_{2-x}Sr_xCoMnO_6$ systems**”

Supervisor : Prof. VenimadhavAdyam

- (http://www.iitkgp.ac.in/fac-profiles/showprofile.php?empcode=bXmWS&depts_name=CR)

- **M.Sc.** in Physics at Sri Venkateswara University, Tirupati, India. 2004-2006
Specialization: “Electronics advanced microprocessors and Atomic Spectroscopy.”
Percentage: **76.04 %**
- **B. Sc.** in Physics, Mathematics, and Computer Sciences at Sri Venkateswara University, India. 2000-2003
Percentage: **83 %**
- **Under graduate** in Physics, Mathematics, and Chemistry at S. U. G. M Jr. College, India. 1998-2000
Percentage: **86.3 %**

Projects under taken in Ph. D course:

- Exploring the multiferroic behavior in the R_2CoMnO_6 ($R = La, Gd, Y$) double perovskites.
- Understanding the magnetic phase diagram of Sr doped La_2CoMnO_6 double perovskites and spontaneous and conventional exchange bias effects in the $La_{2-x}Sr_xCoMnO_6$ ($0 < x < 1$) bulk samples.
- Investigation of the magnetic field induced metamagnetic behavior, effect of field cooled on the sharp magnetization jumps. We have also demonstrated magnetocaloric, electrocaloric and multicaloric effects in Y_2CoMnO_6 and discussed the significance of the sign of magnetoelectric coupling on cooling efficiency.
- Study the effect of rare-earth magnetic (Gd) element on the complex magnetic behavior of Gd_2CoMnO_6 i.e., magnetic field induced spin-glass like behavior and multifunctional properties like, enhanced ferroelectric property, giant magnetocaloric effect near to Gd-spins ordering.

In addition to the above carried out work during my Ph.D., I worked with my colleagues for studying the electrical transport properties in Heusler alloys and magnetic multiferroic thin-films. During my Ph.D., I guided two students for their M. Tech.projects and trained my colleagues and juniors. I have also taken the Lab class teaching work for postgraduate students as a part of my research work. In addition to attending conferences, seminars, I organized weekly group discussion; attend the journal club seminars and yearly research scholars' day seminars for last two years of my Ph.D. work.

Expertise in computer software for data analysis:

- X'pert high score plus (for X-ray diffraction data analysis)
- FullProf (for Rietveld analysis)
- Diamond and Crystal maker (for crystal structure simulation)
- Image J (for Transmission electron microscopy image analysis)
- MultiVu and Labview (for interfacing the instrument)
- MS office, LATEX and Mathematica
- MatLab and Origin 8.5 (for plotting the graphs and fitting the curves)

Languages known: English (professional), Telugu (mother tongue), Hindi, and Kanada.

Research skills:

- *Automation of experimental instrumentation using the LabVIEW software.*
- *Fabrication of the sample holder for low temperature (5-300K) dielectric and pyroelectric measurements.*
- *Development of liquid nitrogen cryostat for temperature dependent (80-450 K) ferroelectric (P-E), dielectric and magneto-dielectric and magneto-resistance measurements.*
- *Synthesis of nanoparticles (metals and oxides) using chemical processing (Sol-gel) methods and bulk polycrystalline sample with conventional solid-state reaction method.*
- *I have learned the FESEM and FIB experimental techniques for the nanostructural fabrication.*
- *Handling of the thin-film deposition techniques like, RF & DC Sputtering and Pulsed laser deposition techniques.*
- *Handling of Cryofree Superconducting Magnetic system (2-300 K) for several physical property measurements such as Resistivity, Impedance, Ferroelectric, Magneto-dielectric, and Pyroelectric current measurements.*
- *Handling of SQUID-VSM magnetometer in doing various sensitive magnetic measurements like, Time-dependent magnetic relaxation, ac susceptibility, dc field superimposed ac susceptibility, and Argand plots (χ'' vs. χ'), DCM and IRM, Magnetocaloric effect and Magnetic bipolar switching measurements under extreme conditions, like low temperatures, high pressures, and high magnetic fields.*
- *Handling of Physical Property Measurement System to characterize the temperature and magnetic field dependent transport and magnetic measurements and specific heat capacity measurements.*
- *I have learned the several characterization techniques like XRD, FTIR, and XPS and XAS.*

Scholastic achievements:

- Cleared joint **CSIR-UGC** national eligibility test (NET) in “Physical Sciences” for “junior research fellowship (CSIR-JRF) and eligibility for lectureship” in 2009.
 - Certification of ‘eligibility for lectureship’ is to be employed as a lecturer in graduate and engineering colleges in India and ‘junior research fellowship’ is to register for Ph.D. anywhere in India.
- During my Ph. D. I have received the “**Best poster award**” for the poster presentation of the work entitled “Magnetocaloric effect in double perovskite $\text{La}_2\text{CoMnO}_6$ ” in DAE-SSPS (2011) national conference held at SRM University, Chennai, India.
- I got the “**Best presentation prize**” for the oral presentation of my work in Research scholar’s day-2010 held at Cryogenic Engineering Centre, IIT Kharagpur, India.
- Having two years teaching experience as lecturer for graduation students, worked at Sri Srinivasa Degree College, Andhrapradesh, India.

Research interests, motivation & future work:

Gigantic magneto-electric coupling between the ferroelectricity and magnetism has been demonstrated in a number of rare-earth perovskite oxides such as manganites, cobaltates, nickelates and ironates with either hexagonal or orthorhombic structures. In terms of applications, multiferroics have shown their distinction as, (i) special layer in a spintronic device to enable electric field control of magnetization and (ii) novel solid-state refrigerant due to their novel multicaloric cooling property.

Throughout my PhD research programme I have carried out a comprehensive study on selected rare-earth (Re) based double perovskites of $\text{Re}_2\text{CoMnO}_6$ systems to investigate the multiferroicity, phase separation and magnetic field driven phenomena like magneto-dielectric, multicaloric, and exchange bias effects. In the family of R_2CoMnO_6 (R= Gd, Eu, Lu and Y), a decrease in rare-earth size can induce significant changes in Co-O-Mn bond angle and bond length which consequently modifies the involved superexchange interactions and ultimately the electronic and magnetic ground states. We have observed multiferroicity and field induced metamagnetic behavior from E*-type antiferromagnetic ($\uparrow\uparrow\downarrow\downarrow$) order to ferromagnetic with sharp jumps in M(H) loops at very low temperatures and high magnetic fields in $(\text{Y}/\text{Eu})_2\text{CoMnO}_6$ systems. To investigate the spin dynamics and its associated effects in those materials near to such a sharp magnetization jumps, we need to study the magnetic field induced,

- (i) structural phase transition and magnetic phase separation phenomena
- (ii) Heat capacity measurements
- (iii) Quantum criticality phenomena
- (iv) Magnetic and magnetostriction measurements with pulsed high magnetic fields at low temperatures
- (v) Spin-state transition of cobalt ions at low temperatures and high magnetic fields.

On the other hand the substitution of magnetic rare-earth (Gd) at Re site i.e. $\text{Gd}_2\text{CoMnO}_6$ system has exhibited multiple magnetic transitions like ferromagnetic ordering ($T_C \sim 112$ K) followed by antiferromagnetic transition ($T_N \sim 47$ K) and paramagnetic ordering of Gd spins at temperatures below 5 K. Further, it exhibits field induced spin glass behavior along with Hopkinson peak features, and exchange bias effect. In this regard I am more interested to study the ferroelectric polarization due to 3d-4f exchange interactions and multicaloric effect below the Gd spin ordering temperature with external high magnetic fields and high pressure.

I am also interested to work in other research areas with excited and emergent topics like, strongly correlated electron systems, highly frustrated magnetic materials and superconducting systems by studying their thermodynamic, electrical, and magnetic properties under extreme conditions: low temperatures, high pressures, and high magnetic fields to construct the phase diagram.

List of publications

- [1] **J. Krishna Murthy**, K. Devi Chandrasekhar, S. Murugavel, and A. Venimadhav, "Investigation of the intrinsic origin of MD effect in $\text{La}_2\text{CoMnO}_6$: Role of magnetic disorder effects" *Journal of material chemistry C*, **3** (2015) 836.
- [2] J. Magesh, P. Murgavel, **J. Krishna Murthy**, V. Adya, and W. Prellier, "A study of magnetic ordering in multiferroic hexagonal $\text{Ho}_{1-x}\text{Dy}_x\text{MnO}_3$ " *Journal of applied Physics* 117 (2015) 836.
- [3] **J. Krishna Murthy**, K. D. Chandrasekhar, H. C.Wu, H. D. Yang, J. Y. Lin and A. Venimadhav "Metamagnetic behavior and effect of field cooling on sharp magnetization jumps in multiferroic Y_2CoMnO_6 " *European physics letters*, **108** (2014) 27013.
- [4] **J. Krishna Murthy** and A. Venimadhav, "Multicaloric effect in Y_2CoMnO_6 multiferroic system". *Journal of Physics D. Applied Physics*, **47** (2014) 445002.
- [5] **J. Krishna Murthy** and A. Venimadhav, "Magnetization reversal phenomena and bipolar switching in $\text{La}_{1.9}\text{Bi}_{0.1}\text{FeCrO}_6$ ", *Physica B*, 448 (2014) 162-166
- [6] **J. Krishna Murthy** and A. Venimadhav, "Giant zero field cooled spontaneous exchange bias effect in phase separated $\text{La}_{1.5}\text{Sr}_{0.5}\text{CoMnO}_6$ " *Applied physics Letters* 103 (2013) 252410.
- [7] **J. Krishna Murthy** and A. Venimadhav, "Reentrant cluster glass behavior in $\text{La}_2\text{CoMnO}_6$ nanoparticles" *Journal of Applied Physics* 113 (2013) 163906.
- [8] **J. Krishna Murthy**, C. Mitra, S. Ram, A. Venimadhav, "Temperature dependent magnetic and dielectric properties of M-type hexagonal $\text{BaFe}_{12}\text{O}_{19}$ nanoparticles". *Journal of alloys and compounds* 545 (2012) 225.
- [9] **J. Krishna Murthy** and A. Venimadhav, "Magnetodielectric behavior in $\text{La}_2\text{CoMnO}_6$ nanoparticles" *Journal of Applied Physics* 111 (2012) 024102.
- [10] K. Devi Chandrasekhar, S. Mallesh, **J. Krishna Murthy**, A. K. Das and A. Venimadhav, "Role of defects and oxygen vacancies on dielectric and magnetic properties of Pb^{2+} ion doped LaFeO_3 polycrystalline ceramics", *Physica B*, 448 (2014) 304-311.
- [11] K. Devi Chandrasekhar **J. Krishna Murthy**, A. K. Das and A. Venimadhav, "Dielectric and Magnetodielectric properties of R_2NiMnO_6 (R= Nd, Eu, Gd, Dy and Y)", *J. Am. Ceram. Soc.*, 1-9 (2014).
- [12] Venimadhav, Devi Chandrasekhar, and **J. Krishna Murthy** "Intrinsic and extrinsic contributions to magnetodielectric effect in double perovskite $\text{La}_2\text{CoMnO}_6$ nanoparticles", *Applied Nano science* 3 (2013) 25-28.
- [13] **J. Krishna Murthy** and A. Venimadhav, "Unusual magnetodielectric response in $\text{La}_2\text{CoMnO}_6$ nanoparticles" *AIP Conference Proceedings* 1447 (2012) 1239.
- [14] **J. Krishna Murthy** and A. Venimadhav, "Magnetocaloric effect in double perovskite $\text{La}_2\text{CoMnO}_6$ " *AIP Conference Proceedings* 1447 (2012) 1235. [This work was received the "Best Poster Award"].
- [15] **J. Krishna Murthy** and A. Venimadhav, "Size-dependent magnetic properties of double perovskite $\text{La}_2\text{CoMnO}_6$ nanoparticles", *AIP Conference Proceedings* 1536 (2013) 1053.

Publications under review/to be submitted

- [1] **J. Krishna Murthy** and A. Venimadhav, "Magnetic field-induced spin-glass and exchange bias effect in $\text{Gd}_2\text{CoMnO}_6$ ", to be submitted.
- [2] K. Devichandrasekhar, **J. Krishna Murthy**, A. Venimadhav and H. D. Yang, "Evaluation of the magnetic field induced glassy behavior and oscillating magnetocaloric effect in $\text{Zn}_{0.05}\text{Ni}_{0.95}\text{Cr}_2\text{O}_4$ spinel oxide", Under review in *Journal of Applied Physics*.
- [3] **J. Krishna Murthy**, K. Devi Chandrasekhar and A. Venimadhav, "Strong correlation of structural, magnetic and transport properties of $\text{La}_{2-x}\text{Sr}_x\text{CoMnO}_6$ ($0 \leq x \leq 1$) polycrystalline samples", to be submitted.
- [4] **J. Krishna Murthy**, K. Devichandrasekhar and A. Venimadhav, "Giant magnetocaloric effect near to Gd-spins ordering temperature in $\text{Gd}_2(\text{Co/Ni})\text{MnO}_6$ double perovskite systems" manuscript under preparation.

CONFERENCES

- [1] National conference on magnetic materials and applications (MAGMA-2010), Kolkata, India.
- [2] 56th DAE-Solid state physics Symposium-2011, SRM University, Chennai, India.
- [3] International conference on nanoscience and nanomaterials, at IIT Guwahati-2011, India.
- [4] International conference on magnetic materials and applications-2013, IIT – Guwahati, India.
- [5] 56th DAE-Solid state physics Symposium-2013, Bikaner, Rajasthan, India.

Personal profile

Date of Birth : 2nd March, 1983
Sex and Marital status : Male and unmarried
Nationality : Indian
Permanent address : J Krishna Murthy
S/O J. Ramaswamy
H. No: 20-30,
Badikayalapalli (Post & Vill),
B. Kothakota (MD),
Chittoor (DT)
Andhra Pradesh, India-517370.
Phone: +91-9609405323 and +91-9177231074

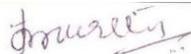
References

- | | |
|--|--|
| <p>(1) Prof. Venimadhav Adyam
Cryogenic Engineering Centre,
Indian Institute of Technology-Kharagpur,
Kharagpur-721302, India
Tel: 09775021822
E-mail: venimadhav@hijli.iitkgp.ernet.in</p> | <p>(2) Prof. V. Srinivas
Department of Physics,
Indian Institute of Technology-Madras,
Chennai-600036, India
Tel: +91-44-2257-4896
E-mail: veeturi@iitm.ac.in</p> |
| <p>(3) Prof. Amal Kumar Das
Department of Physics,
Indian Institute of Technology-Kharagpur,
Kharagpur-721302, India
Tel: +91-3222-283824
E-mail: amal@phy.iitkgp.ernet.in</p> | |

DECLARATION:

I hereby declare that the information furnished above is true to the best of my knowledge.

Date : 18-11-2014,
Place : Kharagpur, India.



(J. KRISHNA MURTHY)