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Name **Dr. K. Ramesh**
Date of Birth June 9, 1964
Institution Department of Physics
Indian Institute of Science, Bangalore-560 012.

Academic and Professional Career

Degree

1. M.Sc. (Applied Physics) Bharathidasan University, Trichy (1987)
2. Ph.D. (Physics) Indian Institute of Science, Bangalore (1999).

Positions held:

Dr. Ramesh has joined the Indian Institute of Science, Bangalore in August 1988. He did his Ph.D. work under the guidance of Prof. E.S.R. Gopal and obtained Ph.D. Degree in June 1999. Currently, he is a Principal Research Scientist in the Department of Physics, IISc, Bangalore.

Postdoctoral Fellow: July 2000 – July 2001
NYSC, Alfred University, Alfred, New York, USA.
(Mentors: Prof. Arun K Varshenya and Prof. Scot Mixture)

Research Scientist: May 2006 – Nov 2007
Ultimosoftware Solutions, USA.

Research Interests:

- Structure property relations in chalcogenide glasses
- Glass formation in chalcogenide systems
- Phase change and electrical switching properties chalcogenide glasses
- Thermoelectric properties of chalcogenide glasses
- Infrared detection and sensing properties of semiconducting chalcogenide glasses
- Shift of glass transition temperature under high pressure (understanding the positive dT_g/dP and negative dT_g/dP)
- Phase transition of solids at elevated pressures and temperatures
- Photovoltaic materials (SnS based and Perovskite based solar cells)
- Synthesis of Nano structured carbon nitrides.

Important contributions

- (i) Main research interest is on the structure property relations in chalcogenide glasses. Glass formation, phase change memory (PCM), physical ageing properties and Infrared transmission in

both bulk and thin films of chalcogenide glasses are of interest. Exploring chalcogenide glass for on-chip nonlinear process for broadband light generation has been initiated. Also, started working on multi layered chalcogenide thin films for low power phase change memory applications by defect engineering.

- (ii) Preparation of chalcogenide glasses using rapid quenching techniques enable his group to prepare glasses in the extended region of glass forming region which unravels many interesting properties.
- (iii) The observation of negative pressure coefficient of glass transition in chalcogenide glasses is significant in understanding the nature of glass transition.
- (iv) Ge-Se-Te glass with IR transmission upto 25 microns has also been prepared for space and defence applications. The IR transmission % is also about 75%.
- (v) The direct transition of $\text{Ge}_2\text{Sb}_2\text{Te}_3$ (GST) to the stable hexagonal phase when doped with Se is an important observation. This work demonstrates that the transition to the metastable cubic phase is not an essential aspect for the fast and efficient phase change non-volatile memory applications. The direct transition to the stable hexagonal phase can also lead to the fast phase change.
- (vi) The effect of atomic size on the phase change properties has been studied on the Ge-Te system by replacing the bigger atom Te by a smaller atom Se.
- (vii) Exploring chalcogenide glasses and glass ceramics for thermoelectric applications.
- (viii) Their group also prepared carbon nitride (C_3N_4) which is predicted to be an ultrahard material with nitrogen atomic % as close to the stoichiometric composition (about 54 % of nitrogen)
- (ix) The contribution in solar cell materials is significant. The work on SnS (non-toxic) solar materials is highly cited. His group also working on Perovskite solar cells.
- (x) Studies on physical ageing and strong/fragile classification in chalcogenide glasses and its relation to structural relaxation is also significant.

Project Undertaken

Sl.No.	Title	Agency	DURATION	Role (PI/CI)
ON-GOING PROJECTS				
1	Synthesis of IR Transmitting Ge-Se-Te Glasses for Space Applications	DST	2022-2024	PI
2	Thermally Stable Ge-Se-Te Semiconducting Glasses for IR Light Transmission	RCI, DRDO	2021-2023	PI
COMPLETED PROJECTS				
1	Semiconducting glasses for harvesting waste heat energy	CSIR	2019-2022	PI
2	Thermally stable semiconducting glasses for IR light transmission	DRDL	2018-2021	PI
3	A large volume furnace for High temperature powder X-ray diffraction studies	DST	2018-2021	PI
4	Development of far-infrared transmitting Te based chalcogenide glasses for space applications	ISRO	2018-2020	PI
5	Physical ageing, intermediate phases and phase change properties of chalcogenide glasses	DST	2013 - 2017	PI
6	New synthesis route to prepare infrared transmitting bulk chalcogenide glasses and glass-ceramics	ISRO	2015-2017	PI
7	Synthesis of nanostructured carbon nitrides	DST	2013 - 2016	PI
8	Preparation of carbon nitrides for space applications	ISRO	2013 - 2015	PI

9	Room temperatures gas sensors based on chalcogenide compounds	JATP	2008 - 2009	PI
10	Off-line approach to non-contact IR sensor technique for estimation of sugars and its byproducts	DBT	2007-2010	CI
11	Infrared transparent chalcogenide glasses: Materials to see beyond visible	ISRO	2011-2013	PI
12	High temperature powder x-ray diffraction studies on some advanced materials and associated instrumentation	DST	2006-2010	PI
13	Investigation of rigidity percolation and type conversion in chalcogenide glasses over extended composition range obtained by rapid quenching	CSIR	2004-2007	PI

List of Publications

Published over 125 peer reviewed papers in International Journals. The list gives the publications in the last 5 years.

1. S Barthwal, R Gupta, A Kumar, **K Ramesh**, S Pathak, S Karak, Band offset engineering in antimony sulfide (Sb_2S_3) solar cells, using SCAPS simulation: A route toward PCE > 10%, *Optik* 282 (2023) 170868.
2. S Chahal, AG Prabhudessai, K Ramesh, Structural relaxation in IR transmitting $(\text{GeSe}_4)_{100-x}(\text{As}_2\text{Se}_3)_x$ glasses, *Journal of Non-Crystalline Solids* 607 (2023) 122220.
3. Shweta Chahal, Akila Gajanan Prabhudesai, Roopali Shekhawat, Vinoth Shanmugam and **K. Ramesh**, "Structure property relationships in critically connected $(\text{GeTe}_4)_{100-x}(\text{As}_2\text{Se}_3)_x$ glasses", *Dalton Transactions* 51 (2022) 12100-12113.
4. SS Hegde, RSC Bose, BS Surendra, S Vinoth, P Murahari, **K Ramesh**, SnS-Nanocatalyst: Malachite green degradation and electrochemical sensor studies, *Materials Science and Engineering: B* 283 (2022) 115818.
5. SS Hegde, BJ Fernandes, V Talapatadur, KP Ramesh, **K Ramesh**, Facile synthesis of cubic SnS/rGO nanocomposites: Structural, optical, and photocatalytic properties, *Materials Today: Proceedings* 62 (2022) 5583-5588.
6. SS Hegde, BJ Fernandes, V Talapatadur, KP Ramesh, **K Ramesh**, Impedance spectroscopy analysis of SnS chalcogenide semiconductors, *Materials Today: Proceedings* 62 (2022) 5648-5652.
7. R. Venkatesh, P. Murahari, N.R Banapurmath, **K. Ramesh**, "Preparation of bamboo-like carbon nitride nanotubes, spheres, and study of their structural, morphological and optical properties", *Nano-Structures & Nano-Objects* 30 (2022) 100878.
8. Dilip Kumar Meena, Rapaka S.C. Bose, S. Vinoth, K, Annapurna, K. **Ramesh**, Impact of melt solidification rate on structural and thermoelectric properties of n-type Bi_2Te_3 alloy, *Applied Physics A* 128 (2022) 1-11.
9. Manikandan Dhamodaran, Ramesh Karuppannan, Danil W.Boukhvalov, Muthu Senthil Pandian, Ramasamy Perumalsamy, "Morphology controlled synthesis of Fe and Mn co-doped In_2O_3 nanocubes and their Dopant-Atom effects on electronic structure and magnetic properties", *J. Mag & Mag. Mater.* 560 (2022) 169547.
10. Manikandan Dhamodaran, Ramaswamy Murugan, Danil W.Boukhvalov, Ramesh **Karuppannan**, Sivasubramani Vedyappan, Muthu Senthil Pandian, Ramasamy Perumalsamy, "Effect of vacancy defects on electronic structure and ferromagnetism in pristine In_2O_3 nanostructures: An experimental study and first-principles modeling", *Materials Research Bulletin*, 152 (2022) 111853
11. Dilip Kumar Meena, Rapaka S.C. Bose, **K. Ramesh**, Melt solidification rate-dependent structural and thermoelectric properties of $\text{Sb}_2\text{Te}_3/\text{Te}$ nanocomposites, *J. Alloys and Comp.* 902 (2022) 163767.
12. Shweta Chahal, K. Ramesh, Glass formation, thermal stability and fragility minimum in Ge-Te-Se glasses, *Materials Research Bulletin* 152 (2022) 1118
13. Roopali Shekhawat, Vinod Erkkara Madhavan, **Ramesh Karuppannan**, "Improved thermal stability and direct hexagonal transition accompanied by metal-insulator transition in Arsenic substituted $\text{Ge}_2\text{Sb}_2\text{Te}_5$ ", *Journal of Alloys and Compounds*, 910 (2022) 164897.

14. R. Packiaraj, Kamaraj Mahendraprabhu, P. Devendran, N. Nallamuthu, Baskaran Palanivel, K.S. Venkatesh and **Ramesh Karuppannan**, "Electrochemical Performances of ZnO–NiO–CuO Mixed Metal Oxides as Smart Electrode Material for Solid-State Asymmetric Device Fabrication", *Energy Fuels*, 36 (2022) 603–617.
15. Koteeswara Reddy Nandanapalli, Devika Mudusu, **Ramesh Karuppannan**, Yoon-Bong Hahn, Sungwon Lee, "Predominantly enhanced catalytic activities of surface protected ZnO nanorods integrated stainless-steel mesh structures: A synergistic impact on oxygen evolution reaction process", *Chem. Eng. J.* 429 (2022) 132360.
16. S.S. Hegde, B.S. Surendra, V.P. Priyanka, Prashantha Murahari, **K. Ramesh**, "SnS/LDPE Composite: A reusable floating photocatalyst for solar degradation of organic dyes", *Mat. Today: Proc.* 47 (2021) 4255-4261.
17. Venkatesh Ramasamy, Pumlianmunga, **Ramesh Karuppannan**, "Synthesis of beta carbon nitride nanostructures by simple CVD-pyrolysis method", *Diamond and Related Materials*, 111 (2021) 108172.
18. R.S.C. Bose, **K. Ramesh**, "Study of anisotropic thermal conductivity in textured thermoelectric alloys by Raman spectroscopy", *RSC Advances*, 11 (2021) 24456-24465.
19. Rakshitha Kallega, Roopali Shekhawat, K. Uday Bhat, **Ramesh Karuppannan**, and Shankar Kumar Selvaraja, "Controlled crystallisation of thermal evaporated GST-on-SOI for photonic neuromorphic application," in OSA Advanced Photonics Congress 2021.
20. Venkatesh Ramasamy, Prashantha Murahari, N.R. Banapurmath and **K. Ramesh**, "Growth of spherical carbon nitride with crystalline alpha and beta mixed phase" *Carbon Trends*, 5 (2021) 100079.
21. Ho Soonmin, S.S. Hegde, **K. Ramesh**, J.K. Dongre, Yousaf Hameed Khattak, Xiang-Hua Zhang, Sadanand, D.K. Dwivedi, D.A. Oeba, "Chalcogenides-based nanomaterials for solar cells and dye sensitized solar cells", Ch. 8: book 'Micro and Nano Technologies', Ed. Mohammad Mansoob Khan, Elsevier (2021), pp 185-218.
22. Roopali Shekhawat, Haritha Pamuluri, Vinod Erkkara Madhavan, **Ramesh Karuppannan**, "Structural transformation and phase change properties of Se substituted GeTe", *Scientific Reports* 11 (2021) 7604.
23. Rapaka S C Bose, K.M. Dilip, Paolo Mele and **K Ramesh**, "Role of grain alignment and oxide impurity in thermoelectric properties of textured n-type Bi-Te-Se alloy", *J. Phys. D: Appl. Phys.* 54 (2021) 235503.
24. K. Deva Arun Kumar, Dilip K. Meena, Rapaka S.C.Bose, Ramcharan Meena, Prashantha Murahari, Paolo Mele, **K. Ramesh**, "Optical and thermoelectric properties of Sb₂Te₃/ZnTe nanostructured composites" *Journal of Alloys and Compounds* 865 (2021) 158621.
25. R. Venkatesh, Pumlianmunga, **K. Ramesh** "Synthesis of Beta Carbon Nitride Nanostructures by Simple CVD-Pyrolysis Method", *Diamond and Related Materials* 111 (2021) 108172
26. S.S Hegde, B.S Surendra, V. Talapatadur, P. Murahari, **K. Ramesh**, "Visible light photocatalytic properties of cubic and orthorhombic SnS nanoparticles", *Chemical Physics Letters*,754 (2020) 137665.
27. K Deva Arun Kumar, Paolo Mele, Joice Sophia Ponraj, Kumar Haunsbhavi, S Varadharajaperumal, D Alagarasan, H Algarni, Basavaraj Angadi, Prashantha Murahari, **Karuppannan Ramesh**, "Methanol solvent effect on photosensing performance of AZO thin films grown by nebulizer spray pyrolysis", *Semiconductor Science and Technology*, 35 (2020) 085013.
28. S. Rex Rosario, I. Kulandaisamy, AMS Arulanantham, K. Deva Arun Kumar, Nasser S Awwad, Hala A Ibrahim, **K. Ramesh**, "Fabrication of heterostructure solar cell using the optimized Sn incorporated PbS films via atomized nebulizer spray pyrolysis", *Materials Science in Semiconductor Processing*, 117 (2020) 1017.
29. P.T. Wilson, R. Ramanna, Shweta Chahal, Roopali Shekhawat, M. Madesh Kumar, **K. Ramesh**, "Local Structure and Electrical Switching in Al₂₀Te₇₅X₅(X=Si, Ge, As, Sb) Glasses", *Appl. Phys. A* 126 (2020) 289.
30. K. Deva Arun Kumar, S. Valanarasu, Prashantha Murahari, Brian Jeevan Fernandes, Joice Sophia Ponraj, Mohamed S. Hamdy, S. AlFaify, **K. Ramesh** "Effect of Er doping on the ammonia sensing properties of ZnO thin films prepared by nebulizer spray technique", *J. Phys. Chem. Solids*, 144 (2020) 10951.
31. S. Rex Rosario, I. Kulandaisamy, K. Deva Arun Kumar, **K. Ramesh**, Hala A. Ibrahim, Nasser S. Awwad, "Ag-doped PbS thin films by nebulizer spray pyrolysis for solar cells", *International Journal of Energy Research*, 44 (2020) 4505-4515.
32. S. S. Hegde, M. Prashantha, B.J. Fernandes, R. Venkatesh, **K. Ramesh**, "Synthesis, thermal stability and structural transition of cubic SnS nanoparticles", *Journal of Alloys and Compounds* 820 (2019) 153116.
33. N. Nallamuthu, **K. Ramesh**, Ramesh Chandra Mallik, "Preparation and Structural Characterization of Ni₃V₂O₈ Nanoparticles for Supercapacitor Applications", *International Journal of Engineering and Advanced Technology* 9 (2019) 3887-389.
34. R. Venkatesh, N.R. Banapurmath, **K.Ramesh**, A.Venkatesh, Swapnil A. Khandake, Pramod R. Kurade, Sachin M.Modagi, M. Nipun Nitin, Ashok S. Shettar, "Enhancement of open circuit voltage of CdTe solar cell", *Materials Today: Proceedings* 27 (2020) 117.

35. Divya Achari, Padma Rachipudi, Satishkumar R. Naik, **Ramesh Karuppunnan**, Mahadevappa Kariduraganavar, "Polyelectrolyte complex membranes made of chitosan-PSSAMA for pervaporation separation of industrially important azeotropic mixtures", *Journal of Industrial and Engineering Chemistry* 78 (2019) 383-395.
36. B.J. Fernandes, **K. Ramesh**, N.K. Udayashankar, "Crystallization kinetics of $\text{Si}_{20}\text{Te}_{80-x}\text{Bi}_x$ ($0 < x < 3$) chalcogenide glasses", *Materials Science and Engineering B* 246 (2019) 34-41.
37. K. Jeyabanu, P. Devendran, A. Manikandan, R. Packiaraj, **K. Ramesh**, N. Nallamuthu, "Preparation and characterization studies of La doped CuS nanospheres by microwave irradiation for high performance supercapacitors", *Physica B: Condensed Matter* 573 (2019) 92-101.
38. P.T. Wilson, S. Chahal, M.M. Kumar, **K. Ramesh**, "27Al MAS NMR investigations on $\text{Al}_{23}\text{Te}_{77}$ glass: Observation of 5-coordinated Al and its influence on electrical switching", *Solid State Communications* 293 (2019) 53-57.
39. Koteeswara Reddy Nandanapalli, Devika Mudusu, Raja Mohan Reddy Lingandhinne, Sekhar Babu Mitta, K. Gunasekhar, **Ramesh Karuppunnan**, Dongmok Whang, "Development of tin (II) sulfide nanostructured films with uniform surface morphology by two-step growth process", *J. Alloys and Comp.* 770 (2019) 600 - 607.
40. Sekhar Babu Mitta, Prashantha Murahari, Koteeswara Reddy Nandanapalli, Devika Mudusu, **Ramesh Karuppunnan**, Dongmok Whang, "Si/ZnO heterostructures for efficient diode and water-splitting applications", *International Journal of Hydrogen Energy*, 43 (2018) 16015 - 16023.
41. Roopali Shekhawat, Ramanna Rangappa, E.S.R. Gopal, **K. Ramesh**, "Effect of Se substitution on the phase change properties of $\text{Ge}_2\text{Sb}_2\text{Te}_5$ ", *AIP Conference Proceedings*, 1953 (2018) 090086.
42. B.J. Fernandes, Pumliamunga, **K. Ramesh**, N.K. Udayashankar, "Thermal stability and crystallization kinetics of Bi doped $\text{Si}_{15}\text{Te}_{85-x}\text{Bi}_x$ chalcogenide glassy alloys", *Materials Today: Proceedings* 5 (2018) 16237-16245.
43. S.S. Hegde, A.G. Kunjomana, P. Murahari, B.K. Prasad, **K. Ramesh**, "Vacuum annealed tin sulfide (SnS) thin films for solar cell applications", *Surfaces and Interfaces*, 10 (2018) 78-84.
44. Brian Fernandes, **Ramesh Karuppunnan**, N. K. Udayashankar, "Electrical switching in $\text{Si}_{20}\text{Te}_{80-x}\text{Bi}_x$ chalcogenide glassy alloys", *J. Non-Cryst. Solids*. 483 (2018) 86-93.
45. Brian JeevanFernandes, Kishore Sridharan, N. Naresh, **K. Ramesh**, N. K. Udayashankar, "Crystallization kinetics of Sn doped $\text{Ge}_{20}\text{Te}_{80-x}\text{Sn}_x$ chalcogenide glassy alloys", *J. Alloys and Compounds*, 721 (2017) 674.
46. **K Ramesh**, Pumliamunga, ESR Gopal, "Electrical switching in Cu doped As-Se glasses", *Technology Letters* 4 (2017) 5-9.
47. Pumliamunga and **K. Ramesh**, "Electrical switching in Sb doped $\text{Al}_{23}\text{Te}_{77}$ glasses", *J. Phys. Chem. Solids* 170 (2017) 68-74.
48. M. Teena, A. G. Kunjomana, **K. Ramesh**, R. Venkatesh and N. Naresh, "Architecture of monophaseInSe thin film structures for solar cell applications", *Solar Energy Materials*, 166 (2017) 190-196.
49. M. Devika, **K. Ramesh**, K R Gunasekhar, E. S. R. Gopal, "Metal-insulator-semiconductor field-effect transistors (MISFETs) using p-type SnS and nanometer-thick Al_2S_3 layers", *RSC Advances* 7 (2017) 11111.
50. Pumliamunga and **K. Ramesh**, Electrical switching, local structure and thermal crystallization in Al-Te glasses, *Materials Research Bulletin* 86 (2017) 88-94.
51. Pumliamunga and **K. Ramesh**, "SET and RESET states of As₂Se₃ doped $\text{Ge}_{20}\text{Te}_{80}$ bulk glasses probed by Raman spectroscopy", *J. Appl. Phys.* 120 (2016) 215105.
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56. Brian JeevanFernandes, Kishore Sridharan, Pumliamunga, **K. Ramesh**, N. K. Udayashankar, "Memory type switching behavior of ternary $\text{Ge}_{20}\text{Te}_{80-x}\text{Sn}_x$ chalcogenide compounds", *J. Appl. Phys. D*, 49 (2016) 295104.
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