



Indian Institute of Technology Delhi
School of Interdisciplinary Research (SIRe)



SIRe Project Number

2023-01-27

(will be assigned by SIRe)

Project Proposal for Ph.D.

Project Details

Project Title

Smart Cooling/Heating Textiles for Thermal Management

Project Summary

(Minimum 500 and maximum 2000 characters)

In current scenario of aggravating global energy crisis, temperature regulation required for human comfort consumes very high amount of energy. In addition to economic concerns, raising average temperatures and frequent heat waves due to climate change may cause severe health issues to public. Textiles play a vital role in shielding and protecting the human body from undesirable hot and cold weather. However, conventional textile is not smart enough to self-regulate the rapid change of temperatures. It is important to develop to textile with localized cooling/heating without intensive energy input. This project aims to develop textiles that can regulate radiative energies for efficient passive cooling/heating through multiscale approach.

Ph.D. Supervisors

Role	Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Prof. Harun Venkatesan	Textile and Fibre Engineering, IIT Delhi	harun@iitd.ac.in
Supervisor 2	Prof. Krishna Bharadwaj Balasubramanian	Department of Material Science and Engineering	bkrishna@mse.iitd.ac.in

Project requirements (Student qualifications, experience required, etc)

- B.Tech / ME / M.Tech (Material Science and Engineering, Polymer science, Textile Chemistry, Textile Engineering, Material Science and Engineering, Chemical Engineering); MSc Textile Chemistry.
- GATE/CSIT-UGC/ NET qualified
- Knowledge of nanomaterials, crosslinking chemistries, coupling reactions.
- Knowledge of fundamental textile design concepts including fiber specification and testing, fabric characterization, textile manufacturing processes, etc.
- Design and fabrication of functional fabric using coating techniques and development of formulations for coating.

Source of fellowship/funding

(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Institute/ Part-time

Role of Faculty Members involved:

Dr. Harun Venkatesan: He will be responsible for the experimental part in developing advanced additives, optimization of formulations, fibre integration and process control to fabricate radiative cooling/heating textiles. His expertise will be utilized in material development and characterization, evaluation of fabrics for physical /chemical, optical, thermal properties and performance assessment through field studies.

Dr. Krishna Bharadwaj Balasubramanian: He will be involved in nanoparticle synthesis, transfer them into textiles through advanced fabrication routes. Further, his expertise of opto-electronic properties will be beneficial in optimizing performance of fabrics for radiative cooling.

Brief profile of the faculty member:

Dr. Harun Venkatesan received his PhD from the Institute of Textiles and Clothing at The Hong Kong Polytechnic University in 2020. Before joining IIT Delhi as an Assistant professor in 2022, he was a research fellow at The Hong Kong University of Science and Technology, supported by prestigious Research Talent Hub Postdoctoral Fellowship. His current research focus on development of aerogels for thermal insulation and radiative cooling properties. He has published more than 12 articles in Q1 journals including Advanced Functional materials, Nature Communications and Advanced Materials and 3 book chapters. He is currently supervising 3 MTech students focused on developing advanced thermal insulation materials. He was recently awarded Start-up Grant from Science & Engineering Research Board.

Dr. Krishna Balasubramanian did his bachelor's in electrical and electronics engineering at PSG College of Technology, Coimbatore. He worked for two years in the hardware design group of optical transport business unit, Cisco Systems Inc. He designed and implemented logical circuits using FPGAs and ASICs for high speed (upto 100 GHz) optical communication channels. Subsequently he joined as a direct PhD candidate at the Indian Institute of Science under the guidance of Prof. Rudra Pratap and Prof. Srinivasan Raghavan. He conducted research on low dimensional layered materials such as graphene, MoS₂ and quantum well structures involving GaN/AlGa_N systems. After obtaining his PhD from the Center for Nanoscience and Engineering, Indian Institute of Science, he joined as a post-doctoral fellow at the ultrafast quantum optics lab in electrical engineering department of Technion – Israel Institute of Technology. He was an assistant professor at the Electrical Engineering department at IIT – Kanpur for an year and currently associated with the department of material science and engineering at IIT - Delhi. His research is focused on the interfaces of superconductors with low dimensional materials for interesting opto-electronic properties. He also works on high-temperature superconducting devices such as single photon detectors, nano-inductors and tunnel/super-Schottky diodes.