PRATEEK VERMA

PHD / POLYMER SCIENTIST

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Polymer scientist and engineer with extensive background in structure-property relationships, metamaterials, machine learning for polymers, processing and characterization, industrial coating technologies and formulations, and organic chemistry.

13 papers published/submitted 11 first-author papers published/in-progress 17 conference presentations 7 leadership roles 12 classes taught

EDUCATION

GEORGIA INSTITUTE OF TECHNOLOGY / 2011 – 2015

PhD, Materials Science and Engineering (polymers), GPA 4.0 / 4.0
Thesis – Auxetic behavior in polymer/fiber network structures

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE / 2006 – 2011

BS and MS, Polymer Science and Technology, GPA 8.5 / 10.0
Thesis – Nanomechanical characterization of tissue engineering polymer blend scaffolds

EXPERIENCE

POSTDOCTORAL

UNIVERSITY OF ARKANSAS / Nayani and Nakarmi groups / 2021 – present

- Lightweight convolutional neural networks (CNNs) for micrographs
- Machine learning algorithms to predict heat-stress in organisms
- Coronavirus sensor design using CNNs on liquid crystal micrographs

GEORGIA INSTITUTE OF TECHNOLOGY / Shofner and Russo groups / 2018 – 2021

- Machine learning for noise detection in scattering data
- Metamaterial composite fabrication using tensegrity/auxetic approaches
- Executive Director (OPALL: Open Polymer Active Learning Laboratory)
  - Established safety, supplies, materials, teams, activities, and website
  - Acted as a liaison between the board of advisors and students

SENIOR COATING CHEMIST

KIMOTO TECH / 2016 – 2018

- Team leader for 5 R&D chemists
- Research and development of protective & flexible coatings exhibiting properties of UV-blocking, scratch and chemical resistance, electrical conductivity, anti-glare, etc.
- Development of conductive coatings and pressure sensitive adhesives
- Scale-up and production of several lab-to-market projects

RESEARCH ADVISOR

for 16 industry members / graduates / undergraduates in the following broad areas

- supervised & unsupervised learning
- industrial coatings
- coacervation thermodynamics
- auxetics and metamaterials
- nanocomposites

*direct supervisor for 13

MENTORSHIP

Served as a mentor for Mentor Jackets, MSE Industry Mentoring and IITR's Alumni Mentorship Program since 2016.

9 Bachelor's students
6 Doctoral students
2 Master's students

DIVERSITY

Percentage of the total 33 advised or mentored

49 % women
16 % hispanics & latinos
07 % african americans
43 % internationals
19 % first-gen college goers

HONORS & AWARDS

2020 Invited talk, IIT Roorkee
2019 Executive Director, OPALL
2019 Hightower Fellow, OPALL
2017 Chairman, Tech. Conference, Kimoto
2014 2nd best poster, Auxetic Conference

EXPERIENCE (CONTINUED)

PHD CANDIDATE

GEORGIA INSTITUTE OF TECHNOLOGY / Griffin and Shofner groups / 2011 – 2015

- Synthesized intrinsically auxetic liquid crystal polymers
- Developed a new protocol for accurately measuring Poisson's ratio
- Developed a new method to induce auxetic properties in nonwovens
- Explained and modeled auxetic behavior of paper
- Analyzed network deformations through micro-CT and finite element analysis
- Established processing-structure-property relations for auxetic response in fiber networks

RESEARCH ASSISTANT (MASTER'S)

UNIVERSITY OF AKRON / Karim group / 2011

- Developed a buckling-based metrology to determine strength of thin films
- Prepared and tested strength of polymer-blend films used in tissue engineering

SUMMER INTERN

UNIVERSITY OF MASSACHUSETTS AMHERST / McCarthy group / 2010

- Synthesized uniformly sized silica nanoparticles for composite applications
- Created super-hydrophobic surfaces using silanes; synthesized cross-linked silicones

SUMMER INTERN

UNIVERSITY OF MINNESOTA / Barocas group / 2009

- Synthesized epoxy networks to study flow through kidney membranes
- Synthesized and characterized collagen gels for tissue engineering

PUBLICATIONS

In the list of 19 total, 13 are published or submitted and 11 are first-author papers (Google Scholar link)

- H Sun, Z Fang, L Zhao, **P Verma**, B Tian, et al.; An ultra-sensitive and stretchable strain sensor based on micro-crack structure for motion monitoring*; in press, Micro Nano (Nature Pub. Group)*; **2022**
- **P Verma**, C Smith, AC Griffin, ML Shofner; Corrigendum: Wool nonwovens as candidates for commodity auxetic materials*; In press. Engineering Research Express*; ERX-101673; **2022**
- Q Kang, X Fang, C Wu, **P Verma**, H Sun, et al.; Mechanical properties and indentation-induced phase transformation in 4H–SiC implanted by hydrogen ions*; Ceramics International*; **2022**
- **P Verma**, C Smith, AC Griffin, ML Shofner; Wool nonwovens as candidates for commodity auxetic materials*; Engineering Research Express*; 2 (4); **2021**
- **P Verma**, C He, AC Griffin; Implications for auxetic response in liquid crystalline polymers*; Physica Status Solidi B*; 2000261; **2020**; (appeared in Wiley's 'Hot Topics: Liquid Crystals')
- N Jappar, **P Verma**, J Holmes; Development of functional films in roll-to-roll manufacturing*; RadTech*; **2018**; (conference paper)
- **P Verma**, ML Shofner, A Lin, KB Wagner, AC Griffin; Induction of auxetic response in needle-punched nonwovens: Effects of temperature, pressure and time*; Physica Status Solidi B*; 253 (7); **2016**
- **P Verma**, ML Shofner, A Lin, KB Wagner, AC Griffin; Inducing out-of-plane auxetic behavior in needle-punched nonwovens*; Physica Status Solidi B*; 252 (7); **2015**
- **P Verma**, ML Shofner, AC Griffin; Deconstructing the auxetic behavior of paper*; Physica Status Solidi B*; 251 (2); **2013**

UNDER REVIEW / SUBMITTED

- **P Verma**, AC Griffin, ML Shofner; Reversibility of auxetic response in polyester fiber needle-punched nonwovens*; Advanced Material Technologies*; 2022
- **P Verma**, C Smith, AC Griffin, ML Shofner; Towards textile metamaterials: A pathway to auxeticity and tensegrity in a needle-punched nonwoven stiff felt*; Materials Advances (RSC)*; 2022
- Q Kang, X Fang, C Wu, **P Verma**, H Sun, et al.; Brittle-plastic transition characteristics and residual stress in scratching 4H-SiC modified by Hydrogen ions*; Precision Engineering*; 2022
- CW Irvin, CC Satam, K Shial, **P Verma**, NB Arroyo, et al.; Tricomponent polymer aerogels containing cellulose nanocrystals and chitin nanofibers and their use in aerogel/hydrogel hybrids as fibrocartilage replacements*; Applied Bio Materials (ACS)*; 2022

SUBMITTING NEXT

- DN Ansari, **P Verma**, TU Ansari; Recovering aerosol chemical composition from temporal variations of total PM mass concentrations: promise of machine learning techniques*; Current Science*; 2022
- **P Verma**, AC Griffin, ML Shofner; Constructing auxetic behavior in paper*; Cellulose*; 2022
- K Copenhaver, S Pennell, S Jain, PS Russo, **P Verma**; Classic Ubbelöhde intrinsic viscosity laboratory exercise made simple and fast*; Journal of Chemical Education*; 2022

IN PROGRESS

- **P Verma**, E Adeogun, ES Greene, S Dridi, U Nakarmi, et al.; Rapid sensing of stress markers and disease onset in poultry using CNN based machine-learning on red blood cell micrographs*; ACS Sensors*; 2022
- **P Verma**, DN Ansari, C Wieting, PS Russo; If Mendeleev had a computer: a re-classification of the periodic table*; Journal of Chemical Education*; 2022
- E Adeogun, **P Verma**, D Iyer, S Srivastava, K Nayani; Formation of liquid crystalline coacervates via the complexation of chromonic mesogens and synthetic polymers*; PNAS*; 2022

PRESENTATIONS

Speakers are italicized

- P Verma, AC Griffin, *ML Shofner*; Nonwoven textile structures – commodity pathways to auxeticity; Chicago (USA); 2022
- *P Verma*, ML Shofner, AC Griffin; Constructing out-of-plane auxetic response in paper; Denver (USA); 65 (1); 2020
- *P Verma*; Career pathways for polymer science students: industry vs higher education; Roorkee (INDIA); 2020; Invited talk
- P Verma, *ML Shofner*, AC Griffin; Auxetic behavior in fiber networks; San Diego (USA); 258; 2019
- *PS Russo*, X Zhang, P Verma, P Balding, G Parkinson, et al.; OPALL: The open polymer active learning laboratory at Georgia Tech; Orlando (USA); 257; 2019
- P Verma, C He, *AC Griffin*; X-ray scattering from LC polymers: Implications for auxetic response; Bedlewo (POLAND); 2019
- *P Verma*, KB Wagner, A Lin, ML Shofner, AC Griffin; Auxetic behavior in paper and nonwovens; Oak Ridge (USA); 2019
- *P Russo*, P Verma, X Zhang et. al.; Open polymer active learning laboratory; Oak Ridge (USA); 2019; poster
- P Verma, ML Shofner, *AC Griffin*; Origin of thickness change in needle-punched nonwovens; Sheffield (USA); 2018
- P Verma, *ML Shofner*, AC Griffin; Auxetic behavior of fiber networks: Paper and nonwoven fabrics; Lake Louise (CANADA); 2017
- P Verma, *ML Shofner*, AC Griffin; Reversibility of thickness change in nonwovens; Crete (GREECE); 2017
- P Verma, ML Shofner, *AC Griffin*; Auxetic liquid crystalline polymers; Crete (GREECE); 2017
- P Verma, ML Shofner, *AC Griffin*; Reversibility of thickness change in nonwovens; Poznan (POLAND); 2016

- *P Verma*, ML Shofner, AC Griffin; Inducing out-of-plane auxetic behavior in needle-punched nonwovens; Poznan (POLAND); 2014
- *P Verma*, ML Shofner, AC Griffin; Auxetic behavior in cellulose based fiber networks; New Orleans (USA); 2013
- *H Yuan*, J Marszalek-Kempke, P Verma, A Karim; Elastic moduli of polymeric thin films of nanocomposites and blends via buckling on elastomeric substrates; Boston (USA); 57 (1); 2012
- P Verma, *ML Shofner*, AC Griffin; Deconstructing the auxetic behavior of paper; Bolton (UK); 2012

TEACHING EXPERIENCE

Year	Course	School	Topic
2020	MSE 4476	Georgia Tech	Guest lecturer / Thermal analysis of polymers
2019	MSE 4476	Georgia Tech	Guest lecturer / Mechanical properties of polymers
2019	MSE 4476 (lab)	Georgia Tech	Guest instructor / DSC and TGA of polymers
2019	MSE 3225 (lab)	Georgia Tech	Guest instructor / Rheology of detergent
2019	MSE 3225	Georgia Tech	Guest lecturer / Polymer rheology
2015	MSE 4476 (lab)	Georgia Tech	Teaching Assistant / DSC and TGA of polymers
2014	MSE 4476 (lab)	Georgia Tech	Teaching Assistant / Step, chain-growth, and emulsion polymerization
2014	MSE 3720	Georgia Tech	Teaching Assistant / Introduction to polymer/fiber enterprise
2014	MSE 4022 (lab)	Georgia Tech	Teaching Assistant / Thermal analysis, processing and rheology of polymers
2013	MSE 4476 (lab)	Georgia Tech	Teaching Assistant / Step, chain-growth, and emulsion polymerization
2013	MSE 4022 (lab)	Georgia Tech	Teaching Assistant / Thermal analysis, processing and rheology of polymers
2012	MSE 1111	Georgia Tech	Teaching Assistant / Introduction to materials science and engineering

HONORS AND AWARDS

1. Postdoctoral Fellowship / U Arkansas / 2021 – 2023
2. Invited talk & career counselling for polymer graduates and undergraduates / IIT Roorkee / 2020
3. Executive Director, OPALL (Open Polymer Active Learning Laboratory) / Georgia Tech / 2019 – 2021
4. Hightower Fellow, OPALL (Open Polymer Active Learning Laboratory) / Georgia Tech / 2019 – 2021
5. Postdoctoral Fellowship, from Renewable Bioresources Institute / Georgia Tech / 2018 – 2020
6. Chairman, Technical Conference / Kimoto Tech / 2017
7. 2nd prize, poster competition (Auxetic Conference) / Georgia Tech / 2014
8. PhD Fellowship, from Institute of Paper Science and Technology / Georgia Tech / 2012 – 2015
9. Chairman, National Polymer Conference, Cognizance / IIT Roorkee / 2009
10. Merit-based scholarship with tuition waiver / IIT Roorkee / 2007 – 2011

RESEARCH FUNDING

Contributed to the planning, writing, editing and/or review of the following research funding proposals.

1. Developing liquid crystal based rapid optical sensors for detecting airborne viruses with SARS-CoV-2 and alpha-coronaviruses; **NSF PIPP**; PI: K Nayani; 2021
2. Awarded; Imaging and quantification of mitochondrial dynamics in response to mechanical stress; **AIMRC**; PI: K Nayani; 2021
3. Development of liquid crystal based wearable sensors for detecting airborne coronaviruses; **PEW Biomedical**; PI: K Nayani; 2021
4. Purification and rapid assessment of filled adeno-associated viral vectors; **MAST UCRC**; PI: K Nayani; 2021
5. Awarded; Development of convolutional neural networks that connect molecular signatures to rapid optical readouts on the health of chickens; **USDA NIFA**; PI: K Nayani; 2020
6. Zero-angle depolarized scattering (ZADS) and data analytics to determine molecular weight distributions of conjugated polymers; **DOE FOA**; PI: PS Russo; 2020
7. Awarded; Open Polymer Active Learning Laboratory: enhancing Georgia Tech's polymer profile in the residential higher-educational institution of tomorrow; **GT COE**; PI: PS Russo; 2020

STUDENT RESEARCH ADVISING

direct supervisor for*

Name	Topic	Year	Journey
Honglin Liu	Machine learning models for noise detection in light scattering data	2021 – present	PhD candidate (Georgia Tech)
Evan Perez*	Building custom convolutional neural networks	2021 – present	Sophomore (University of Arkansas)
Brandon Tipton	Isothermal titration calorimetry	2021 – present	Junior (University of Arkansas)
Lauren Holm*	Nanocellulose dispersion and auxetic composites	2019 – 2020	Freshman (Georgia Tech)
Marilyn Tesi*	Polyurethane and silicone auxetic composites	2019 – 2020	Sophomore (Georgia Tech)
Casey Smith*	Auxetic behavior in wool and stiff-felt fabrics	2018 – 2019	Senior > PhD candidate (Georgia Tech)
Daniel Corella*	Gloss and haze control in coatings	2017 – 2018	Formulations Chemist (Kimoto Tech) > Development Chemist (Birla Carbon)
Carly Wieting*	Color correcting coatings for electronic displays	2017 – 2018	R&D Chemist (Kimoto Tech) > MBA student (Georgia State) > Data Scientist (Takeda Pharmaceuticals)
Joseph Holmes*	Anti-glare and anti-sparkle coatings for touch screens	2016 – 2018	R&D chemist (Kimoto Tech)
Thomas Vinson*	Protective hardcoats with adhesive backings	2016 – 2018	R&D Chemist (Kimoto Tech) > Formulation Scientist (Meggit Aerospace)
Jennifer Evans*	Silicone pressure sensitive adhesives	2016 – 2017	R&D Chemist (Kimoto Tech) > R&D Chemist (CyCan Industries) > Associate Senior Scientist (Pharmaceutical Associates Inc)
Stephen Edwards*	Antiglare, but also high-clarity, coatings	2016 – 2018	R&D Chemist (Kimoto Tech)
Karla Wagner*	Auxetic behavior in needle-punched nonwovens	2013 – 2014	Sophomore > PhD candidate (Georgia Tech)
Tony Shu*	Measurement of auxetic responses	2013 – 2014	Sophomore (Georgia Tech) > PhD candidate (MIT)
Emily Fitzharris	Cellulose and PVA based nanocomposites	2013 – 2015	Junior > PhD candidate (Georgia Tech) > Senior Engineer (Exponent)
CJ Layer*	Auxetic response of paper	2012 – 2012	Sophomore (Georgia Tech) > Vice President (Electrical Cable Specialists)

LEADERSHIP

1. DEI council representative for research staff in the department / Georgia Tech / 2019 – 2021
2. Co-launched, Postdoc Chats, series of social and professional development gatherings for postdocs campuswide / Georgia Tech / 2019 – present
3. Advisor, to graduate and undergraduate members and users, OPALL Polymer Makerspace / Georgia Tech / 2019 – present
4. Team Leader, for 5+ industry research scientists / Kimoto Tech / 2016 – 2018
5. Co-manager, Polymer Thermal Analysis Lab / Georgia Tech / 2013 – 2015
6. Student President (elected, Saharanpur Campus) / IIT Roorkee / 2008 – 2009
7. Founder and Team Leader, intranet web development / IIT Roorkee / 2007 – 2011

MENTORSHIP

Serving as a mentor for GT Mentor Jackets, GT MSE Industry Mentorship Program and IITR Alumni Mentorship Program

Name	Year	Journey
Bachelor's		
Jaejung Kim	2021 – present	Sophomore (Georgia Tech)
Tanmay Sarkar	2020 – present	Sophomore (IIT Roorkee)
Nadia Zaragoza	2019 – 2021	Junior (Georgia Tech) > PhD candidate (MIT)
Steven Koskey	2019 – 2021	Senior > Master's student (Georgia Tech)
Dillan Cothran	2018 – 2019	Senior (Georgia Tech) > Engineer (Universal Alloy)
Michael O'Neill	2017 – 2018	Freshman (Georgia Tech) > Intern (Lockheed Martin Space)
Amanda Luce	2017 – 2018	Senior (Georgia Tech) > QA Coordinator (ALPLA Group)
Ankit Kuchhangi	2016 – 2017	Freshman (Georgia Tech) > PhD candidate (UC Los Angeles)
Sabrina Gallego	2016 – 2017	Sophomore (Georgia Tech) > Senior Quality Engineer (Mainstay Medical)
Doctoral		
Elizabeth Adeogun	2021 – present	PhD candidate (U Arkansas)
Homa Ghaedi	2021 – present	PhD candidate (U Arkansas)
Krishna M Sankar	2019 – 2020	PhD candidate (Georgia Tech)
Hongmo Li	2017 – 2018	PhD candidate (Georgia Tech)
Sahitya Movva	2017 – 2018	PhD student (Georgia Tech) > Process Engineer (Intel Corporation)
Helen Wei-Ya Chen	2016 – 2017	PhD student (Georgia Tech) > Process Engineer (Intel Corporation)
Master's		
Pragya	2021 – present	Master's student (IIT Roorkee)
Ada Del Cid	2018 – present	Master's student (Georgia Tech) > Senior Research Associate (Tessera Therapeutics)

SKILLSETS

POLYMERS

- AUXETIC MATERIALS
- BIOPOLYMERS
- CHARACTERIZATION
- COACERVATES
- LIQUID CRYSTALS
- MACHINE LEARNING
- NETWORK DEFORMATIONS
- NETWORKS
- POLYMER PROCESSING
- SILANES AND SILICONES
- STRUCTURE-PROPERTY RELATIONSHIPS
- THERMAL ANALYSIS
- THIN FILMS
- TISSUE ENGINEERING
- VISCOELASTICITY

CHEMISTRY

- FREE-RADICAL POLYMERIZATION
- LCE SYNTHESIS
- POLYURETHANE SYNTHESIS
- SILANE CHEMISTRY
- SILICONE SYNTHESIS
- THERMAL CURING
- UV CURING

DEEP LEARNING

- CNNS
- IMAGE PROCESSING
- NEURAL NETWORKS
- RESNETS
- SUPERVISED LEARNING
- SVMS

DATA SCIENCE

- CLUSTERING
- LINEAR REGRESSION

COMPUTER LANGUAGES

- ACTIONSCRIPT
- C/C++
- JAVASCRIPT
- MATLAB
- PHP
- PYTHON
- SQL

LAB TECHNIQUES

- AFM
- DMA
- DSC
- ENVIRONMENTAL TESTING
- FTIR
- ITC
- MECHANICAL TESTING
- MICRO-CT
- SEM
- TGA
- VISCOMETRY

INDUSTRY

- ADHESIVE COATINGS
- BAR COATING
- BATCH MIXING
- COATING FORMULATIONS
- HARD COATS
- SCALE-UP OPERATIONS
- SLOT DIE COATING
- THERMAL CURING
- UV CURING

INTERPERSONAL

- CAREER COUNSELLING
- ILLUSTRATION
- LEADERSHIP
- MENTORING
- RESEARCH ADVISING
- SPEAKING
- TEACHING
- TEAM BUILDING

COMPUTATIONAL

- ABAQUS
- CHEMOFFICE
- DJANGO
- MATERIAL STUDIO
- MATLAB
- MATPLOTLIB
- MOLECULAR OPERATING ENV.
- NUMPY
- PANDAS
- PILLOW
- TENSORFLOW

SCIENTIFIC REVIEWING

Reviewed manuscripts for the following journals:

- Applied Sciences (MDPI)
- Computational Materials Science (Elsevier)
- Industrial & Engineering Chemistry Research (ACS)
- Journal of Engineered Fibers and Fabrics (Sage)
- Journal of Micromechanics and Microengineering (IOP)
- Journal of Rheology (AIP)
- Machines (MDPI)
- Materials Research Express (IOP)
- Sensors (MDPI)
- Surface and Coatings Technology (Elsevier)

EXTRACURRICULARS

- Gets way too excited about web development and graphics design
- Is the best table tennis player in the break room
- Paints and draws

REFERENCES

ANSELM C GRIFFIN
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