

# MERLYN X. PULIKKATHARA

18806 COVE MILL LANE  
CYPRESS, TX 77433  
(281)839.5967  
MEPULIKKATHARA@PVAMU.EDU



## HIGHLIGHTS OF QUALIFICATIONS

---

- Dedicated scientist with more than 10 years' experience in chemical based research for product innovation and development for aerospace, petroleum and biomedical applications
- Research in biomedical industry included cell culture studies with nanoparticles, RF studies with mice, modification of nanoparticles for biomedical studies
- Five years of oilfield chemistry research involved thermal visbreaking of heavy oil, nanomaterials in development of paraffin inhibitors, for high temperature sand settling applications and stimulation fracturing fluids
- Over 6 years' experience in the leadership & organizational development fields through research, observation, writing, speaking, teaching and mentoring
- Successfully managed and executed industrial and research project related to flow assurance (wax) issues; product development
- Emulsion formation/breaking studies
- Authored or co-authored over 25 reviewed journal and conference papers & presentations
- Innovations resulted in 6 patents
- Familiar with various lab equipment and analytical techniques related to oil and gas industry including: Fluid loss core test, viscosity, sand settling, FTIR, AFM, SEM, CPM, pH, DLS, Zeta Potential
- Highly innovative in developing and delivering new programs, training, and learning & development solutions to business needs
- Well-developed skills in leading virtual teams composed of people from various locations around the world
- Strong teaching abilities by smooth and easy transfer of knowledge to others
- Well-built project management, team/people development, organizational, analytical and problem solving skills

## PROFESSIONAL EXPERIENCE

---

### Lecturer II

Prairie View A&M University

Prairie View, Texas USA 2017-

Taught courses in Physics, Chemical Engineering, and graduate Mechanical engineering course.

Collaborate extensively with Electrical Engineering

- Faculty Senate Speaker
- Science Taskforce
- Tutored science to education majors, all passed State Exam in Science
- Technical mentor to graduate students in nanotechnology based research
- Research is based on surface physics of nanomaterials and its applications

### **Research Associate**

Baylor College of Medicine Houston, Texas USA

2015-2016

Improved process of RF heating in research and development projects.

- Nanoparticles/ionic solutions for RF [13.56 MHz] heating studies on macrophage, HeLa cells
- Led research of nanomaterials in cells for SEM imaging
- Nanoparticle study as a pretreatment for Gemcitabine on Panc1, ASPC, HDPE, Macrophage cells

### **Chemical Engineer**

Schlumberger Sugar Land, Texas USA

2013-2014

Well Services Pressure Pumping & Chemistry Group

Development of fracturing fluids with nanoparticles with team of technicians/scientists/engineers.

- Researched boron cross-linked guar, modified guar polymers, viscoelastic surfactants
- Formulated and experimented with water chemistry, brine base solutions with nanoparticle formulations for fracturing fluid development
- Chemistry community co-leader of internal knowledge sharing network, led volunteer team to product patent reports, technology briefs, newsletters, webinars to over 20,000 members internationally
- Innovated two patents about additives into production chemistry and acid based project
- Innovation project demonstrated technical feasibility and potential financial benefits including increasing market share of chemical inhibitors
- Internal reports on nanoparticles additive on various brines at high temperatures, studies of different breakers on resulting filter cake on cores with fluid loss, viscosity, DLS, turbidity, sand settling
- Mentored various technicians in lab procedures
- Responsible for hiring technicians to support various projects
- Presented technical results to business development managers

### **Research Scientist**

Schlumberger Edmonton, Alberta Canada

2009-2013

Researched and developed visbreaking technology for heavy oil. Goal to establish the operating window of the novel technology to meet transport requirements was achieved. Led the chemistry effort in planning, perform experiments, collaborating with lab team to obtain and analyze data to make technical recommendations to business development managers.

- Initiated and led internal Think Tank innovation team of cross disciplinary engineers, scientists, technicians with a result of over 24 research proposals addressing technical challenges relevant to business needs to management; Featured on corporate webpage
- Analyzed the visbroken heavy oil products to assess energy/economic benefits of novel heating method over conventional technology
- Leader of HSE team, performed safety inspections, risk analysis of various projects, ensured center wide compliance and presented to center safety manager
- Various internal publications and presentations to technical/business management team about the chemistry of the visbreaking heavy oil
- Identified areas for intellectual property opportunities for various business units in new products and applications
- Contributed to two design patents involving microwave technology



Designed and performed various experiments to study the effects of space radiation on nanomaterials with the use of energized beams protons, neutrons, gamma rays, and iron ions at Los Alamos, Brookhaven national laboratories and Texas A&M Cyclotron Institute

- Created carbon nanotube films and composites for radiation studies
- Collaborated with multidisciplinary teams to study the effects of radiation on SpaceHab cross sections, cords of the parachute from the X38 CRV, and other materials
- Initiated and developed project and team for the successful selection and flight on the KC-135 “Vomit Comet” for microgravity experiments, first time proposal from PVAMU was selected
- Presented research in USA and South Korea

**Student Engineer**

Schlumberger El Tigre, Venezuela 2000

Integrated Project Management

International internship in Venezuela with goal of assessment of oil production by analyzing chemical demulsifier vs. high-pressure gas lift for oil recovery

- Initiated tour of learning different aspects of oil well drilling and testing of fluids of onshore wells
- Analyzed production rates, pressure and temperature profiles of 100+ wells across various sand types
- Worked with field engineers of mobile testing units to take pressure/temperature readings of well heads
- Presented recommendations to field and office managers

**Research Assistant**

University of Oklahoma Norman, Oklahoma USA 1999

Physics- Chemical Physics

Project goal of creating and optimizing conductive polymer chemistry utilizing Differential Scanning Calorimetry

- Optimizing PEO/ionic salts in time, heat range studies with DSC
- Presented internally to research team

**EDUCATION**

---

PhD Applied Physics [Chemistry] 3.8/4.0	Rice University	2009
Masters [Chemical] 3.6/4.0	Prairie View A&M University	2004
BS Chemical Engineering & Physics 3.0/4.0	Prairie View A&M University	2001

**SUPPLEMENTAL EDUCATION**

Well Stimulation: Practical & Applied Training Course, PetroSkills	2014
Formation Damage: Causes, Prevention, and Remediation, PetroSkills	2013
HSE for management, Schlumberger	2012
Leadership Soup Workshop, Dream Achievers Academy	2012
Leadership, Schlumberger	2011
Petroleum fluids, Schlumberger	2011

Project Management, Schlumberger	2010
Thermodynamics/EoS, Schlumberger	2010

## HONORS & AWARDS

---

Best Faculty Award in Physics: PVAMU	2019
Completion of Advance Program in Schlumberger	2013
Certificate of Appreciation, Leader of HSE team, Schlumberger	2012
Excellence in Chemistry Teaching Award-Rice University	2007
NASA Graduate Student Research Program Fellowship	2005
NASA Harriet Jenkins Pre-Doctoral Fellowship	2003
Graduate Student of the Year Medal-Engineering PVAMU	2003
Tau Beta Pi, National Engineering Honor Society PVAMU	2002
Invited speaker to NASA Graduate Student Panel	2002
Chaired Nanophysics session, Nanospace conference	2002

## LEADERSHIP ROLES

Initiated Think Tank at Schlumberger, Schlumberger	2013
Loss Prevention Team leader, Schlumberger	2013
Women in Science, Engineering, and Research, Schlumberger	2013
Graduate Advisor Proposal Writer of KC-135 Microgravity Experiment	2004
President of Deans Council in Engineering	2002
President of Omega Chi Epsilon- Chemical Engineering Honor Society	2001
President of Sigma Pi Sigma- Physics Honor Society	2001
President of Society of Physics Students	2001

## PATENTS/PUBLICATIONS/PRESENTATIONS

---

### Patents:

- Schlumberger: Li Jiang, Mohan Kanaka Raju Panga, Christopher Scot Daeffler, Olga Vladimirovna Nevvonen, Merlyn Xavier Pulikkathara, Sergey Makarychev-Mikhailov, Jack Li, Yi Sun. "Preparation method, formulation and application of chemically retarded mineral acid for oilfield use." US Patent App. 14/824,362
- Schlumberger: M. X. Pulikkathara, Shekhar Kandehar, "Submicron particles to enhance oil recovery." IS13.4491 [2014]
- Schlumberger: M. X. Pulikkathara, Shawn Taylor, Amin Aseedafar, Wai Min Tam, David Obrien,"Resonant Cavity for Microwave Visbreaking of Crude Oil." IS13.3435 [2013]

4. Schlumberger: M. X. Pulikkathara, Shawn Taylor, Amin Aseedafar, Wai Min Tam, David Obrien “Multi-Stage Reactor for Microwave Visbreaking of Crude Oil.” IS13.3549 [2013]
5. Rice University: M. X. Pulikkathara, V. N. Khabashesku, “Polymer Composites Mechanically Reinforced with Long Chain Alkyl and Urea Functionalized Nanotubes.” US 8,809,979
6. Rice University/Prairie View A&M University: EV Barrera, R Wilkins, M Shofner, M. X. Pulikkathara “Functionalized carbon nanotube-polymer composites and interactions with radiation.” US Patent 8,809,979, 2014

**PUBLICATIONS: AS OF JUNE 22, 2020: H-INDEX=14, #CITATIONS= 557**

1. S Kyatsandra, M Pulikkathara, R Wilkins X-ray radiation effects on thin film nanocomposites of functionalized and copper coated multi-walled carbon nanotube and poly (methyl methacrylate) *Surfaces and Interfaces* 17, 100362. 2019.
2. SY Neeraja Dharmaraja , Stacey L. Piotrowskia, Chen Huangc , Jared M Newton, Leonard S. Golfmana , Aurelie Hanoteaud , Sandeep T. Koshyf, Aileen W. Li, Merlyn X. Pulikkathara , Bing Zhange , Jared K. Burksk , David J. Mooney, Yu L. Lei , Andrew G. Sikorad Anti-tumor immunity induced by ectopic expression of viral antigens is transient and limited by immune escape. *ONCOIMMUNOLOGY* 8 (4). 2019.
3. Merlyn Pulikkathara, Colette Mark, Natasha Kumar, Ana Maria Zaske, Rita E.Serda. “Sucrose modulation of radiofrequency-induced heating rates and cell death.” *Convergent Science Physical Oncology*, Volume 3, Number 3. 2017.
4. Mayra Hernández-Rivera, Ish Kumar, Stephen Y. Cho, Benjamin Y. Cheong, Merlyn X. Pulikkathara, Sakineh E Moghaddam, Kenton Herbert Whitmire, and Lon J. Wilson. “A high-performance hybrid bismuth/carbon nanotube-based contrast agent for X-ray CT imaging.” *ACS Appl. Mater. Interfaces*, DOI: 10.1021/acsami.6b12768. Publication Date (Web): January 10, 2017.
5. Ware, M.J., Nguyen, L.P., Law, J.J., Martyna Krzykawska-Serda, Kimberly M. Taylor, Hop S. Tran Cao, Andrew O. Anderson, Merlyn Pulikkathara, Jared M. Newton, Jason C. Ho, Rosa Hwang, Kimal Rajapakshe, Cristian Coarfa, Shixia Huang, Dean Edwards, Steven A. Curley & Stuart J. Corr. A new mild hyperthermia device to treat vascular involvement in cancer surgery. *Nature\_Sci Rep* 7, 11299 (2017) doi:10.1038/s41598-017-10508-6
6. Jin, M., Eblimit, A., Pulikkathara, M. X., Corr, S., Chen R., Mardon G. “Conditional knockout of retinal determination genes in differentiating cells in *Drosophila*” *FEBS J.* Aug; 283(15):2754-66. 2016.
7. VN Khabashesku, MX Pulikkathara, R Lobo. “Synthesis of carbon nanotube—nanodiamond hierarchical nanostructures and their polyurea nanocomposites” *Russian Chemical Bulletin* 62 (11), 2322-2326. 2013.

8. O. V. Kuznetsov, A. Cole, M. X. Pulikkathara, and V. N. Khabashesku. "Sidewall Alkylcarboxylation of Carbon Nanotubes Through Reactions of Fluoronanotubes With Functional Free Radical Initiators." *Russ. Chem. Bull.*, 60 (11) , pp. 2212-2221. 2011.
9. O. V. Kuznetsov, M. X. Pulikkathara, R.F. M. Lobo, V. N. Khabashesku. "Solubilization of Nanocarbons, Nanotubes, Nano-Onions and Nanodiamonds Through Covalent Functionalization with Sucrose." *Russ. Chem. Bull.*, 59(8), 1495-1505, 2010.
10. Rita E. Serda Aaron Mack, Merlyn Pulikkathara, Ana Maria Zaske, Ciro Chiappini, Jean R. Fakhoury, Douglas Webb, Biana Godin, Jodie L. Conyers, Xue W. Liu, James A. Bankson, and Mauro Ferrari. "Cellular association and assembly of a multistage delivery system." *Small*, 6(12), 1329-1340, 2010.
11. Peter J. Boul, Kathryn Turner , Jing Li, Merlyn X. Pulikkathara , R. C. Dwivedi , Edward D. Sosa, Yijiang Lu, Oleksandr V. Kuznetsov, Pdraig Moloney , R. Wilkins, Mary Jane O'Rourke, Valery N. Khabashesku, Sivaram Arepalli, and Leonard Yowell "Real-Time Nanotube-Based Proton Dosimeters." *J. Phys. Chem. C.*, 113, 14467-14473, 2009.
12. M. X. Pulikkathara, O. V. Kuznetsov, C. Wei, V. N. Khabashesku. "Medium density polyethylene composites with functionalized carbon nanotubes." *Nanotechnology* 20, 195602, 2009.
13. V. K. Rangari, M. Yousuf, S. Jeelani, M. X. Pulikkathara, V.N. Khabashesku. "Alignment of carbon nanotubes and reinforcing effects in Nylon-6 polymer composite fibers." *Nanotechnology*, 19, 2008.
14. Merlyn Pulikkathara, Valery Khabashesku, "Sidewall Covalent Functionalization of Single-Walled carbon Nanotubes Through Reactions of Fluoronanotubes with Urea, Thiourea, and Guanidine." *Chem. Mater.* 20, 2685-2695, 2008.
15. M. X. Pulikkathara, V.N. Khabashesku. "Covalent Sidewall Functionalization of Single-Walled Carbon Nanotubes by Amino Acids." *Russ. Chem. Bull.* 57 (5), 2008.
16. Valeri A. Davydov, Aleksandra V. Rakhmanina, Stephane Rols, Viacheslav Agafonov , Merlyn X. Pulikkathara, Randall L. Vander Wal, Valery N. Khabashesku, "Size-dependent phase transition of diamond to graphite at high pressures." *J. Phys. Chem. C*, 111, 12918-12925, 2007.
17. H. Lu, J. Goldman, F. Ding, Y. Sun, M.X. Pulikkathara, V.N. Khabashesku, "Friction and Adhesion Properties of Vertically Aligned Multi-Walled Carbon Nanotube Arrays and Fluoro-Nanodiamond Films." *J. Lou, Carbon*, 46, 1294, 2008.
18. K. P. Meletov, I. O. Bashkin, V. V. Shestakov, A. V. Krestinin, V. A. Davydov, M. X. Pulikkathara, V. N. Khabashesku, J. Arvanitidis, D. Christofilos, and G. A. Kourouklis, "Raman study of hydrogenated and fluorinated single-wall carbon nanotubes." *Fullerenes, Nanotubes and Carbon Nanostructures* 16, 593-596, 2008.
19. Mircea Chipara, K. Lozano, Richard Wilkins, E. V. Barrera, M. X. Pulikkathara, Laura Penia-Para and Magdalena Chipara, "ESR investigations on polyethylene-single wall carbon nanotube composites." *Journal of Materials Science*, 43(4) 1228-1233 , 2008.

20. V. N. Khabashesku and M. X. Pulikkathara, "Chemical modification of carbon nanotubes." *Mendeleev Comm.* 61-66, 2006.
21. M. X. Pulikkathara, Meisha L. Shofner, Richard T. Wilkins, Jesus G. Vera, Enrique V. Barrera, Fernando J. Rodríguez-Macías, Ranji K. Vaidyanathan, Catherine E. Green, Clay G. Condon. "Fluorinated Single Wall Nanotube/Polyethylene Composites for Multifunctional Radiation Protection." *Mat. Res. Soc. Symp. Proc.* 740, 2002.
22. P. Padmini, R. K. Pandey, M. X. Pulikkathara, R. Wilkins, "Neutron Radiation Effects on the Nonlinear Current-Voltage Characteristics of Ilmenite-Hematite Ceramics." *Applied Physics Letters.* 82(4) 2002.

#### PRESENTATIONS:

1. S Kyatsandra, M Pulikkathara, R Wilkins X-ray radiation effects on thin film nanocomposites of functionalized and copper coated multi-walled carbon nanotube and poly (methyl methacrylate). NanoSMT 2018. **First place poster prize.**
2. M. X. Pulikkathara, Kang, Jungho; Pulikkathara, Merlyn; Khabashesku, Valery; Kelly, Kevin, "Fluorination and Defluorination of Double-wall Carbon Nanotubes." American Physical Society, 2008 APS March Meeting, March 10-14, 2008.
3. M.X. Pulikkathara, "Proton Radiation Effects on Functionalized Carbon Nanotubes." Nano Summit, Texas A&M University, 2007.
4. Merlyn X. Pulikkathara, Valery Khabashesku "Sidewall Covalent Derivatization of Fluorinated Single Wall Carbon Nanotubes Using Urea and Related Structures." Invited. American Chemical Society 62nd Southwest Regional Meeting, Houston, 2006.
5. M. Pulikkathara, J. Vera, M. Shofner, R. Wilkins, E. V. Barrera, J. Read and T. S. Reese, "Proton and Neutron Irradiation Effects on Electrical Resistivity of Single Wall Carbon Nanotubes." Poster Competition [3<sup>rd</sup>] Rice University, 2002.
6. M. Pulikkathara, R. Wilkins, J. Vera, L. K. Fotedar, E. V. Barrera, T. S. Reese, H. Huff, R. C. Singleterry, Jr., B. Syed, "Radiation Effects Risk Analysis and Mitigation of Carbon Nanomaterials and Nanocomposites." Radiation Protection and Shielding Division Topical Proceeding of the American Nuclear Society Conference, Santa Fe, NM. 2002.
7. M. Pulikkathara, J. Vera, M. Shofner, R. Wilkins, E. V. Barrera, "Energy Dependence of Proton Irradiation Effects on the Electrical Resistivity of Carbon Nanotubes." NanoSpace , Galveston, TX, 2002.
8. M. Pulikkathara, J. Vera, M. Shofner, R. Wilkins, E. V. Barrera, J. Read and T. S. Reese, "Proton and Neutron Irradiation Effects on Electrical Resistivity of Single Wall Carbon Nanotubes." Nanotube 2002 Conference, Boston, MA, 2002.
9. T. Tolpa, R. Wilkins, M. Pulikkathara, "The Center for Applied Radiation Research, Capabilities of Prairie View A&M University in Radiation Research, Experimentation and Modeling." Nano-Vivo Summit, Houston, TX, 2002.



10. M. X. Pulikkathara, R. Wilkins, Meisha Shofner, Jerry Vera, Enrique V. Barrera, Fernando Rodriquez-Macias, R. Vaidyanathan, C. Green, C. Condon, "Fluorinated Single Wall Nanotube/Polyethylene Composites for Multifunctional Radiation Protection.", Invited Talk. Materials Research Society Meeting, Boston, MA, 2002.

### **Teaching Statement**

When I think of the teachers that had a profound effect on me, I realize they all had something in common, their sincere dedication to their students, knowledge of their subject and wish to inspire their students. This is foundation from which I also hope to connect with my students. As an Assistant/Associate Professor in Physics at Prairie View A&M University, I intend to accomplish this by having: specific learning goals for my students, methods to engage my students, and criteria in which to assess if the teaching goals have been met.

Having had the opportunities to learn from premier institutes such as Rice University and Max Planck Institute for Solid State Physics, I am aware of the current challenges that are being explored through nanotechnology. Industrial experience in petroleum and post-doc experience in biomedical field have given me the appreciation of working with multi disciplinary teams effective project management. To prepare my students to meet these challenges, I intend on teaching from my expertise in nanotechnology in the aerospace, petroleum and biomedical fields.

I have taught and served students from the Department of Physics and the College of Education. My recent teaching experiences has resulted in the metric of a 4.7/5.0 with over 40% response rate from the Student Opinion Surveys from the Spring 2019 semester. I have received the Best Faculty Award in Physics in Fall of 2019. I believe in an evolving teaching methodology as I continuously learn to become a better teacher for my students to meet specific goals.

Specific goals:

- Being aware of evolving teaching methods to maximize learning
- Increase understanding of the state of the art in nanotechnology in various fields
- Increase women in science and engineering fields

Methods to achieve these teaching goals include:

- Problem based learning in classrooms instead of only straight lecturing
- Have students teach each other and present in class
- Teaching of fundamental principles and development of new courses in nanotechnology with mechanical engineering applications
- Have team based projects that include project management tasks
- Mentor Women in Science activities: Science fairs, seminars

As an example of my teaching methods, while I was a graduate teaching assistant in Rice University Chemistry Department, I had to explain about mechanical properties of heated interstitial inclusions/alloys. To demonstrate this principle, I had one student bend a bar of an unheated alloy and another student to try to bend the annealed bar, which was of course so difficult. Everyone in the class was at once engaged and surprised, since both bars looked exactly alike. Once I got their attention, I began to explain the role of heat and interstitial sites and how alloys form. Then I asked them for alloys they encounter in their daily lives, they connected concept with their everyday lives.

Another example, was when I had participated in a Nanotechnology workshop at Rice University given to middle and high school teachers where I had taught these teachers about carbon single

walled nanotubes and suggested activities for students of various levels. Included in my presentation, was a short film I made about microwaving nanotubes to understand the how small metal catalysts could be. I connected the known concept from a macro scale to the nano scale.

My methods of teaching introduction to chemistry laboratory, while at Rice University, resulted in receiving the Harry B. Weiser Award in Excellence in Teaching in 2008 by the Department of Chemistry. At the time, I was the first PhD student that not in Chemistry to do so. This is in reference to my interdisciplinary background [Engineering and Science] for effective teaching.

I have advised [technical and career] Ph.D. students in Chemical Engineering at the University of Alberta as a mentor in their WISE [Women in Science and Engineering] Program, as well as masters students, undergraduate, and high school students in my time at Rice University, Schlumberger and Baylor College of Medicine.

The criteria in which to asses my teaching methods include:

- Pre/Post assessments
- Quantified class analysis of team presentations on class projects
- Number of team nanotechnology based innovation proposals submitted

It is through these specific teaching goals, evolving teaching methods, and assessment criteria in which I plan on preparing my students to engage and contribute to the technical challenges that we face. I am confident my high expectations, interdisciplinary background and teaching style will benefit my Physics students at Prairie View A&M University.

## Research Plan at PVAMU: Development of NanoX: Interdisciplinary team solving problems through Nanotechnology

My research plan involves the experience I had gained from years in industry and academia in the field of nanotechnology. Specifically, I intend on increasing my portfolio of chemically functionalized nanomaterials for building in four areas within nanotechnology: Radiation studies, Biomedical applications, Petroleum solutions, and Environmental impacts. I will describe my expertise in the aforementioned areas and my plan on developing a team of diverse nanotechnology experience to collaboratively achieve funded productivity in these research directions.

I have expertise in chemically functionalizing nanomaterials with urea and similar moieties[1], amino acids[2], sucrose[3], functionalized free radicals[4] perfluorinated chains which enhanced mechanical properties in polyethylene[5]. I had functionalized fluorinated nanotubes with nanodiamonds[6]. I had created polymer nanocomposites for studies with ESR[7], alignment of nanofibers[8], and created nanodiamond coated glass for frictional studies[9]. My skills with characterizing nanomaterials which had been shown in my publications included Raman spectroscopy, XRD, FTIR, TGA, DSC, AFM, SEM, TEM, Confocal, fluorescence, XPS, tensile strength, DLS/Zeta potential, four point probe, among others. I had completed Raman spectroscopy studies of phase transitions of diamonds to graphite[10]. I had imaged Bismuth functionalized on nanotubes for X-ray studies with SEM/EDS[11]. My work in chemically functionalized materials are summarized here in a review[12] and in a book chapter of my work with fluorinated nanomaterials[13]. Patents of my work on nanomaterials include the following:

1. Rice University: M. X. Pulikkathara, V. N. Khabashesku, "Polymer Composites Mechanically Reinforced with Long Chain Alkyl and Urea Functionalized Nanotubes." US 8,809,979
2. Rice University/Prairie View A&M University: EV Barrera, R Wilkins, M Shofner, M. X. Pulikkathara "Functionalized carbon nanotube-polymer composites and interactions with radiation." US Patent 8,809,979, 2014

The Radiation direction would encompass both space level type of radiation and earth based cancer research studies. My experience in radiation studies initially included neutron effects with ilmenite-hematite structures[14] which lead to research developing a functionalized nanotube sensor for proton detection[15], studying the effects of proton irradiation on polyethylene[16], and use of fluorinated nanomaterials for radiation protection studies[17]. On campus collaborations for radiation studies include Professor Wilkins, Director of NASA CARR/CRESE, his former and current students Dr. Shubha Kyatsandra and Guddi Karna. My nanomaterials studies began in his laboratory and has guided my research in this area.

The biomedical application direction is focused on cell studies with nanomaterials, such as mesoporous silicon nanoparticles that served as multistage for release of various nanomaterials to study distribution of nanomaterials[18]. The study of RF on cells with sucrose has been investigated to observe the effect of RF on osmotic solutions[19] and the changes in cell morphology utilizing confocal, fluorescent microscopy. My experience in cancer projects have also included studying hyperthermia in vascular involvement in cancer surgery[20] and anti-tumor immunity[21]. My on campus collaborators in biomedical research with nanomaterials include: Dr. Carson from Agriculture, Dr. Kim from Electrical Engineering. My off-campus collaborators are Dr. Mackeyev from Mayo Institute, Dr. Rita Serda from University of New Mexico and Dr. Debeb from M.D. Anderson [new collaboration].

The Petroleum direction would include research into asphaltenes, prevention of wax in pipelines, and other nanomaterial solutions appropriate for the petroleum industry. I have internal within the Chemical Engineering Department in Chemistry, and outside collaborators with Shell. Work was done was primarily published as secret internal reports. However, I list here a series of public patents developed from my time in the petroleum industry:

1. Schlumberger: Li Jiang, Mohan Kanaka Raju Panga, Christopher Scot Daeffler, Olga Vladimirovna Nevvonen, Merlyn Xavier Pulikkathara, Sergey Makarychev Mikhailov, Jack Li,

Yi Sun. "Preparation method, formulation and application of chemically retarded mineral acid for oilfield use." US Patent App. 14/824,362

- Schlumberger: M. X. Pulikkathara, Shekhar Kandehar, "Submicron particles to enhance oil recovery." IS13.4491 [2014]
- Schlumberger: M. X. Pulikkathara, Shawn Taylor, Amin Aseedafar, Wai Min Tam, David Obrien, "Resonant Cavity for Microwave Visbreaking of Crude Oil." IS13.3435[2013]
- Schlumberger: M. X. Pulikkathara, Shawn Taylor, Amin Aseedafar, Wai Min Tam, David Obrien "Multi-Stage Reactor for Microwave Visbreaking of Crude Oil." IS13.3549 [2013]

The Environmental direction with nanoparticles is a new field for me, but I am confident with my collaborators in Physics and Chemistry, that it will be successful. Dr. Ashley-Leonard is an environmental toxicologist and Dr. Peter Instiful is an atmospheric physicist, with our combined expertise, we will be productive.

To date, I have participated in three proposals that were recently submitted, as listed in Table 1:

Table 1. List of submitted proposals

Sponsor	Title	PI	My role	Budget [\$]	Date Submitted
Department of Education	STEM Impact Scholar Program (SISP)	Kevin Storr	Co-Investigator/ 20%	722,793	19-Jul-2019
Department of Education	Institutional Integration of Applied Thermal and Combustion Sciences into Engineering and Science Curricula by Engaging Experiments and Research Opportunities	Yuhao Xu	Co-PI / 20%	749,997	20-Aug-2019
National Science Foundation	REU Site: Undergraduate Nanotechnology Inspiration Through Science (UNITS)	Richard Wilkins	Co-PI / 33.33%	405,000	28-Aug-2019

To increase the productive synergy of nanotechnology at PVAMU, I have initiated a collaborative group called Nano X, composed of those that have nanotechnology experience from diverse fields, in hopes to bring a synergistic discussion resulting in proposals and relevant research projects with our combined expertise.

The list thus far includes the following faculty at PVAMU shown below in Table 2.

Table 2. List of faculty associated with nanotechnology experience

Name	Department	Expertise
Dr. M.X. Pulikkathara	Physics	nanoparticle functionalization for aerospace, petroleum, and biomedical industries
Dr. Orion Ciftja	Physics	theory of interactions at the nanoscale; nanoscale semiconductor quantum dots; nano-size electronic clusters and molecular magnetism
Dr. Kevin Storr	Physics	XRD, Magnetic fields
Dr. Peter Instiful	Physics	Atmospheric Physics
Dr. R. T. Wilkins	ECE	radiation physics, radiation effects on electronics and nanomaterials
Dr. L. Carson	Agriculture	synthesis of metal nanoparticles for environmental
Dr. N. Shamim	CHEG	Graphene Coated Polyurethane foam with Imbedded Magnetic Nanoparticle for oil uptake
Dr. Y. Li	Chemistry	Polymer Nanoparticles

Dr. Oki	Chemistry	Various nanoparticle studies
Dr. G. Neelgund	Chemistry	Various nanoparticle studies
Dr. H. Wang	College of Arts Science	DNA damage checkpoint control in cells exposed to ionizing radiation
Dr. H. Fernando	Chemistry	
Dr. M. Fontus	Ass. Director UMA	
Dr. Stephanie Burrs	MECH	Nanomaterial mediated biosensor design and fabrication for physiological sensing.
Dr. S. Zhou	MECH	Synthesis, characterization and stability of chitosan and poly(methyl methacrylate)grafted carbon nanotubes”,
Dr. Ashley Leonard	Chemistry	Environmental toxicology
Dr. E. Dada	CHEG	nanomaterials
Dr. Michael Gymerah	CHEG	nanomaterials

I am currently working on other proposals including the following proposals to elicit funds for my proposed research. Please see Table 3 below.

Table 3. List of proposals currently in progress

Name of solicitation	Agency	\$	deadline	Area/topic
Fundamental Research to Counter Weapons of Mass Destruction Frbaa 14-24 amendment 9 posting HDTRA1-14-24-FRCWMD-BAA	Department of Defense Defense Threat Reduction Agency	(e.g., \$25K) up to \$1M annually	The pre-application white paper deadline is 4 March 2019. We can prepare for next year.	This involves the exploration and exploitation of interactions between materials and various electromagnetic phenomena, molecules, nuclear radiation, and particles.  investigations of the interaction of radiation with sensitive electronics and systems as well as development of novel materials and methods that are robust against radiation effects
<a href="#">Innovative Research in Cancer Nanotechnology (IRCN) (R01)</a> <a href="#">PAR-17-240</a> <a href="https://grants.nih.gov/grants/guide/pa-files/PAR-17-240.html">https://grants.nih.gov/grants/guide/pa-files/PAR-17-240.html</a>	National Institutes of Health (NIH)	\$450K in direct costs per year maximum project period is 5 years	11/21/19	Innovative Research in Cancer Nanotechnology (IRCN, covered by this FOA) Awards. IRCN awards support smaller, well-defined projects aimed mainly at discovery research. Their focus is to develop further understanding of nanomaterial and/or nanodevice interactions with biological systems and the mechanisms of nanoparticle and/or nanodevice delivery to the desired and intended cancer targets in vivo.

I have summarized my research experience and proposed a research plan to be developed at PVAMU collaboratively with my colleagues experienced in nanotechnology. I have listed proposals I have participated in, and included a few proposals I am currently working on.

In conclusion, I hope my research plan is of interest to you and I look forward to discussing them in further detail with you.

#### References

- [1] M. X. Pulikkathara, O. V. Kuznetsov, and V. N. Khabashesku, "Sidewall covalent functionalization of single wall carbon nanotubes through reactions of fluoronanotubes with urea, guanidine, and thiourea," *Chem. Mater.*, vol. 20, no. 8, pp. 2685–2695, 2008.
- [2] M. X. Pulikkathara and V. N. Khabashesku, "Covalent sidewall functionalization of single-walled carbon nanotubes by amino acids," *Russ. Chem. Bull.*, vol. 57, no. 5, 2008.
- [3] O. V. Kuznetsov, M. X. Pulikkathara, R. F. M. Lobo, and V. N. Khabashesku, "Solubilization of carbon nanoparticles, nanotubes, nano-onions, and nanodiamonds through covalent functionalization with sucrose," *Russ. Chem. Bull.*, vol. 59, no. 8, pp. 1495–1505, 2010.
- [4] O. V. Kuznetsov, A. Cole, M. Pulikkathara, and V. N. Khabashesku, "Sidewall alkylcarboxylation of carbon nanotubes through reactions of fluoronanotubes with functional free radicals," *Russ. Chem. Bull.*, vol. 60, no. 11, 2011.
- [5] M. X. Pulikkathara, O. V. Kuznetsov, I. R. G. Peralta, X. Wei, and V. N. Khabashesku, "Medium density polyethylene composites with functionalized carbon nanotubes," *Nanotechnology*, vol. 20, no. 19, 2009.
- [6] V. N. Khabashesku, M. X. Pulikkathara, and R. Lobo, "Synthesis of carbon nanotube - Nanodiamond hierarchical nanostructures and their polyurea nanocomposites," *Russ. Chem. Bull.*, vol. 62, no. 11, pp. 2322–2326, 2013.
- [7] Mircea Chipara, K. Lozano, Richard Wilkins, E. V. Barrera, M. X. Pulikkathara, Laura Penia-Para and Magdalena Chipara, "ESR investigations on polyethylene-single wall carbon nanotube composites," *J. Mater. Sci.*, vol. 43, no. 4, 2008.
- [8] V. K. Rangari, M. Yousuf, S. Jeelani, M. X. Pulikkathara, and V. N. Khabashesku, "Alignment of carbon nanotubes and reinforcing effects in nylon-6 polymer composite fibers," *Nanotechnology*, vol. 19, no. 24, 2008.
- [9] H. Lu, J. Goldman, F. Ding, Y. Sun, M.X. Pulikkathara, V.N. Khabashesku, "Friction and adhesion properties of vertically aligned multi-walled carbon nanotube arrays and fluoronanodiamond films," *Carbon N. Y.*, vol. 46, no. 10, 2008.
- [10] Valeri A. Davydov, Aleksandra V. Rakhmanina, Stephane Rols, Viacheslav Agafonov , Merlyn X. Pulikkathara, Randall L. Vander Wal, Valery N. Khabashesku, "Size-dependent phase transition of diamond to graphite at high pressures," *J. Phys. Chem. C*, vol. 111, no. 35, 2007.
- [11] Mayra Hernández-Rivera, Ish Kumar, Stephen Y. Cho, Benjamin Y. Cheong, Merlyn X. Pulikkathara, Sakineh E Moghaddam, Kenton Herbert Whitmire, and Lon J. Wilson. "High-Performance Hybrid Bismuth-Carbon Nanotube Based Contrast Agent for X-ray CT Imaging," *ACS Appl. Mater. Interfaces*, vol. 9, no. 7, 2017.
- [12] V. N. Khabashesku and M. X. Pulikkathara, "Chemical modification of carbon nanotubes," *Mendeleev Commun.*, vol. 16, no. 2, pp. 61–66, 2006.
- [13] V. N. Khabashesku, O. V Kuznetsov, M. X. Pulikkathara, and S. C. Nanotubes, "Carbon

- Nanotubes : Fluorinated Derivatives ST PA ST PA.”
- [14] P. Padmini, M. Pulikkathara, R. Wilkins, and R. K. Pandey, “Neutron radiation effects on the nonlinear current-voltage characteristics of ilmenite-hematite ceramics,” *Appl. Phys. Lett.*, vol. 82, no. 4, 2003.
- [15] Peter J. Boul, Kathryn Turner , Jing Li, Merlyn X. Pulikkathara , R. C. Dwivedi , Edward D. Sosa, Yijiang Lu, Oleksandr V. Kuznetsov, Pdraig Moloney , R. Wilkins, Mary Jane O’Rourke, Valery N. Khabashesku, Sivaram Arepalli, and Leonard Yowell., “Single wall carbon nanotube response to proton radiation,” *J. Phys. Chem. C*, vol. 113, no. 32, 2009.
- [16] M. X. Pulikkathara ,Pena-Paras, L., Mc Intosh, D.,Chipara, M.,Wilkins, R.,Barrera, E.V.,Dye, D. Zaleski, J.M., “Proton beam induced modifications in multi-functional polyethylene-based carbon nanotubes composites,” in *Materials Research Society Symposium Proceedings*, 2005, vol. 851.
- [17] M. X. Pulikkathara, Meisha L. Shofner, Richard T. Wilkins, Jesus G. Vera, Enrique V.Barrera, Fernando J. Rodríguez-Macías, Ranji K. Vaidyanathan, Catherine E. Green, Clay G. Condon., “Fluorinated single wall nanotube/polyethylene composites for multifunctional radiation protection,” in *Materials Research Society Symposium - Proceedings*, 2002, vol. 740.
- [18] Rita E. Serda Aaron Mack, Merlyn Pulikkathara, Ana Maria Zaske, Ciro Chiappini, Jean, R. Fakhoury, Douglas Webb, Biana Godin, Jodie L. Conyers, Xue W. Liu, James A., Bankson, and Mauro Ferrari., “Cellular association and assembly of a multistage delivery system,” *Small*, vol. 6, no. 12, pp. 1329–1340, 2010.
- [19] M. Pulikkathara, C. Mark, N. Kumar, A. M. Zaske, and R. E. Serda, “Sucrose modulation of radiofrequency-induced heating rates and cell death,” *Converg. Sci. Phys. Oncol.*, vol. 3, no. 3, p. 035001, 2017.
- [20] Matthew J. Ware, Lam P. Nguyen, Justin J. Law, Martyna Krzykawska-Serda, Kimberly M. Taylor, Hop S. Tran Cao, Andrew O. Anderson, Merlyn Pulikkathara, Jared M. Newton, Jason C. Ho, Rosa Hwang, Kimal Rajapakshe, Cristian Coarfa, Shixia Huang, Dean Edwards, Steven A. Curley and Stuart J. Corr .., “A new mild hyperthermia device to treat vascular involvement in cancer surgery,” *Sci. Rep.*, vol. 7, no. 1, pp. 1–14, 2017.
- [21] Neeraja Dharmaraj, Stacey L. Piotrowski, Chen Huang, Jared M. Newton, Leonard S. Golfman, Aurelie Hanoteau, Sandeep T. Koshy, Aileen W. Li, Merlyn X. Pulikkathara, Bing Zhang, Jared K. Burks, David J. Mooney, Yu L.Lei, Andrew G. Sikora & Simon Young., “Anti-tumor immunity induced by ectopic expression of viral antigens is transient and limited by immune escape,” *Oncoimmunology*, 2019.