

Education

Ph.D. Mechanical Engineering at Michigan Technological University	08/2013-08/2016
M.S. Bioengineering at University of Illinois at Chicago	08/2011 – 08/2013
B.S. Bioengineering at University of Illinois at Chicago	08/2008– 08/2011

Summary

I have a 5+ years of experience working Independently in proposal driven research projects by following SOPs, PPE, ISO and FDA standards. I demonstrate multiple skills including product development of the assigned project, develop the characterization techniques to test and validate the product, data analysis experience resulted in scientific publications, work management through managing multiple projects individually and in collaboration with clinicians, surgeons and scientists, team leading with group of 4 or more, prompt decision-making during experiments, teaching and mentoring high school, undergraduate and graduate students, quick learning whether its scientific instruments, methodologies, or fundamentals, and problem solving ability. I have also received 8 awards including Outstanding Scholarship Award in the department of Mechanical Engineering at Michigan Technological University in 2016.

Technical Skills

- **Microscopy Techniques:** Field Emission Scanning Electron Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Energy Dispersive X-ray Spectroscopy, X-ray Diffraction Spectroscopy.
- **Biophysical and Biochemical Techniques:** Fourier Transform Infrared Spectroscopy, Fluorescence Microscopy, Thermogravimetric analysis, Goniometer, UV-Vis Spectrometer, Nano-Drop, MicroPlate Reader,
- **Molecular Biology Techniques:** Cell culture with different cell lines: MG63, hMSCs, and MRC-5, MTT assay, cell passage, cell staining, qPCR, cell fixation, cell dehydration, cell freezing, cytotoxicity testing, ELISA, qPCR
- **Material Science and Engineering:** Surface modification through sandblasting and acid etching, Nanotubes formation through Electrochemical Anodization, annealing using two zone and single zone furnace, some exposure to atomic layer deposition technique.
- **Electrochemical Testing:** Three electrode electrochemical cell, Corrosion Properties of Material, Open Circuit Potential, Electrochemical Impedance Spectroscopy, Potentiostatic test, Potentiodynamic Test.
- **Mechanical Testing:** Instron load frame, interfacial stress analysis, energy dissipation, Force displacement curve, Mechanical property of biomaterial, adhesion test, 3-point test.
- **Product development and manufacturing:** Product Requirement Definition (PRD), Food and Drug Administration (FDA) analysis, Failure Mode Effect Analysis (FMEA)
- **Software:** Fluent user of Microsoft Office: Microsoft Word, Microsoft Powerpoint, Excel, SPSS, Smart Draw software to create 3D models
- **Personal Characteristics:** Excellent communication skills, data analysis, prompt decision-making ability, excellent work management, team leading, teaching skills and quick learning ability.

WORK EXPERIENCE

Research Specialist at UIC

Current

- Write proposal related to medical devices, diagnostics methodology, therapeutics, and water filtrations systems.
- Advise and lead master's students with their thesis projects, conduct meetings to schedule, plan and organize experiments.
- Investigator of the Total Knee Replacements retrievals to understand their failure mechanism.
- Project manager of "*Biomimetic Surface for Antibacterial TJR*" in collaboration with Colleagues from Rush University Medical Center.
 - Design and Develop experimental plan, test the protocol, validate the hypothesis, characterize the chemical and morphological structure, analyze the results, and compile technical reports.
- Project manager "*Antibacterial TiO₂ nanotube surface for cardiovascular electronic devices and limb prosthesis to fight implant associated infection and enhance cellular adhesion*" in collaboration with cardiovascular surgeon at college of medicine, UIC, and Rehabilitation Institute of Chicago.
 - Design and Develop experimental plan, test the protocol, validate the hypothesis, characterize the chemical and morphological structure, analyze the results, and compile technical reports.
- Project manager "*Resolving Heterotopic Ossification Issue in Patients with Total Joint Replacement,*" in collaboration with clinical surgeons at college of dentistry, UIC.
 - Design and Develop experimental plan, test the protocol, validate the hypothesis, characterize the chemical and morphological structure, analyze the results, and compile technical reports.
- Supervise and advise Undergraduates for their research projects

Graduate Research Assistant at MTU

2013-2016

- Designed and conducted experiments to investigate electrochemical, mechanical, and biological properties of biomaterials.
- Worked on designing smart multifunctional implant surface that can serve as drug delivery system in order to systematically release drug upon need.
- Engineered a novel surface with Transparent TiO₂ nanotubes on ZrO₂ using electrochemical anodization techniques
- Characterized the materials surface using Field Emission Scanning Electron Microscopy, Transmission Electron Microscopy, Energy Dispersive X-ray Spectroscopy, Fourier Transform Infrared Spectroscopy, X-ray Photo Electron Spectroscopy and Water Contact Angle Analysis.
- Utilized Gramy Instruments to perform Electrochemical Testing
- Utilized Instron Machine to perform Mechanical Testing

- Investigated the Biocompatibility Properties of Biomaterials using MTT assay, Fluorescence staining and microscopy, Field Emission Scanning Electron Microscopy and Q-PCR.
- Excellent comprehensive data reporting and data analysis led me to have 10 publications.
- Build excellent communication and presentation skills by presenting in 7 conferences annually with poster/podium presentations where I talked about my research.
- Maintained the lab safety Environment and equipment's.
- Developed a strong relationship with dentists, medical doctors, and engineers.
- Performed various projects at a same time within different laboratories
- Demonstrated the professional and leadership skills by becoming a poster session chair during 144th and 145th annual meeting of The Minerals, Metals and Materials Society, and Student Representative of Institute to Biotechnology, Tribocorrosion and Nanomedicine, and Society of Biomaterials.

Mentoring at UIC and MTU

2011-current

- Demonstrate excellent leadership Skills by mentoring Masters, Undergraduate (from UIC and NSF Research Experiences for Undergraduate students), and High School (Illinois Math and Science Academy) Students
- Overlook students projects related to electrochemistry, electrochemical anodization, *in-vitro* testing
- Teach laboratory techniques and fundamental concepts within my expertise,
- Help in designing and guiding the projects related to biomedical implants
- Advise regarding the comprehensive data analysis, writing articles and review papers.

Teaching Experience at UIC and MTU

- BioE 102 Seminar: Nanotechnology and Nanomedicine March 16, 2016
- Mentoring Masters Students in Bioengineering Department, 2015-current
UIC
- FESEM Seminar in BIOE 594, UIC February 9th, 2016
- Instructor of Engineering Biomechanics (MEEM 4180): September 2014
Fundamentals of Biomechanics at MTU
Lecture 1: Kinematics Preliminaries: Center of Mass
Lecture 2: Kinematics Preliminaries: Special Force System
(Zero systems, couples, equivalent force systems) and
equivalent insertion force
- Instructor of Engineering Biomechanics (MEEM 4180): November 2013
Fundamentals of Biomechanics at MTU
Lecture 1: Kinematics Preliminaries: Center of Mass

Lecture 2: Kinematics Preliminaries: Special Force System
(Zero systems, couples, equivalent force systems) and
equivalent insertion force

- Mentored Bioengineering Undergraduate Students at UIC 2012-2013
- Mentored Illinois Math and Science Academy Students 2012-2013
- Mentored NSF Research Experiences for Undergraduate (REU) students in Bioengineering Department 2012-2013

Research Experience

- PhD Research Focuses on preparing smart Bio-Implants' surface for dental and orthopaedic implants by combining nanotechnology with medicine. The main objective of my research was to fabricate mechanically and electrochemically robust well-organized TiO₂ nanotubes with multipurpose benefits. In order to achieve the objectives, various experiments were conducted. 1) Investigating the mechanical and electrochemical stability of TiO₂ nanotubes (TNTs) by performing controlled insertion and pull out test from different density simulant bone with or without the presence of salt and protein solution using Instron Machine. 2) Investigating the toxicity of TNTs particles with various concentrations. 3) Investigating the corrosion resistance properties of drug loaded nanotubes using Gamry Potentiostat. 4) Fabricating transparent TiO₂ nanotubes for addressing tissue discoloration problem in patients with thin gingiva and 5) Fabricating the antibacterial TiO₂ nanotubes by incorporating silver nanoparticles using reverse polarity electrochemical technique. 2013-2016
- Master Research Focused on Functionalization and Characterization of CP-Ti and Ti-6Al-4V Surfaces for Biomedical Implants. Atomic Layer Deposition and electrochemical anodization techniques were used to functionalize Ti surfaces with conformal TiO₂ layer and TiO₂ nanotubular layer. Surfaces were characterized using Fourier transform infrared spectroscopy, surface wettability, X-ray Photoelectron Spectroscopy, Grazing incidence X-ray Diffraction. Integer eleifend diam eu diam. Nam hendrerit. Nunc id nisi. 2011-2013
- Bachelor's research focused on Bio-Tribocorrosion aspect of Hip and Dental Implants. Electrochemical stability of Cp-Ti was investigated in acidic environment that mimics the infection conditions in the vicinity 2010-2011

of dental and hip implants. In order to investigate the electrochemical stability of Cp-Ti during low pH, open circuit potential, potentiodynamic, potentiostatic and electrochemical impedance spectroscopy was performed.

Publications

- Arghya K Bishal, Bela Joshi, **Sweetu B. Patel**, Arman Butt, Su Huang, Bin Yang, Tolou Shokuhfar, Cortino Sukotjo, Christos G. Takoudis, "Atomic Layer Deposition in Bio-Nanotechnology: A brief overview" *Journal of Biomedical Engineering*, Accepted, 2016
- John Grotberg, Azhang Hamlekhan, Arman Butt, **Sweetu Patel**, Dmitry Royhman, Tolou Shokuhfar, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Thermally oxidized titania nanotubes enhance the corrosion resistance of Ti6Al4V. *Materials Science and Engineering: C*, 2016. 59: p. 677-689.
- **Sweetu B Patel**, Azhang Hamlekhan, and Tolou Shokuhfar, *Drug-Eluting Nanotubes for Cellular Bioactivity, in Microscale Technologies for Cell Engineering*, A. Singh and A.K. Gaharwar, Editors. 2016, Springer International Publishing. p. 305-318.
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Tolou Shokuhfar, Nanotopography and Surface Stress Analysis of Ti6Al4V Bioimplant: An Alternative Design for Stability. *JOM*, 2015: p. 1-16.
- **Sweetu B. Patel**, Azhang Hamlekhan, Dmitry Royhman, Arman Butt, Judy Yuan, Tolou Shokuhfar, Cortino Sukotjo, Mathew T. Mathew, Gregory Jursich, Christos G. Takoudis, Enhancing surface characteristics of Ti-6Al-4V for bio-implants using integrated anodization and thermal oxidation. *Journal of Materials Chemistry B*, 2014. 2(23): p. 3597-3608.
- Azhang Hamlekhan, Arman Butt, **Sweetu Patel**, Dmitry Royhman, Christos Takoudis, Cortino Sukotjo, Judy Yuan, Gregory Jursich, Mathew T. Mathew, William Hendrickson, Tolou Shokuhfar, Fabrication of Anti-Aging TiO(2) Nanotubes on Biomedical Ti Alloys. *PLoS ONE*, 2014. 9(5): p. e96213.
- Arman Butt, **Sweetu B. Patel**, Azhang Hamlekhan, Dmitry Royhman, Tolou Shokuhfar, Cortino Sukotjo, Mathew T. Mathew and Christos G. Takoudis, A Novel Investigation of the Formation of Titanium Oxide Nanotubes on Thermally Formed Oxide of Ti-6Al-4V. *J Oral Implantol*, 2015. 41(5): p. 523-531.
- **Sweetu Patel**, Arman Butt, Qian Tao, Jorge Ivan Rossero, Dmitry Royhman, Cortino Sukotjo and Christos Takoudis, "Novel Functionalization of Ti-V Alloy and Ti-II using Atomic Layer Deposition for Improved Surface Wettability," *Colloids and Surfaces B: Biointerfaces Journal*, Volume 115, 1 March 2014, Pages 280–285 (2014)

- Hamilton, M.D., Butt, A., **Patel, S.**, Sukotjo, C., and Takoudis, C.G.: Characterization of Anatase Phase on Calcinated Titanium-V Alloy. *Journal of Undergraduate Research*. 6: 16-19. 2013
- Funk, C., John, G., **Patel, S.** and Ansari, L.: Circulatory Model of Blood Pressure, Resistance, and Flow Rates of a Mouse. *UIC Bioengineering Student Journal*. Vol.III (1): 18-24. 2011

Conferences/Presentations

- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, " Corrosion Property of Vitamin D loaded nanotubes for Bio-implants application in an *in vitro* environment," World Biomaterials Congress, Montreal, Canada, (2016)
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, " Synergistic Effect of Mechanical and Electrochemical Impact on the Survivability of Nanotubes," Clinical Research Day at College of Dentistry, UIC, (2016)
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, " Suitability Of Vitamin D Loaded Nanotubes For Improved Bone-Implant Integration: An Electrochemical Investigation," Orthopaedic Research Society, Orlando, FL, USA, (2016)
- **Sweetu Patel**, Cortino Sukotjo, Christos Takoudis, Mathew T Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, " Hip Femoral Stem Insertion Simulation With Biomimetic TiO₂ Nanotube Decorated Ti6Al4V Surface," Orthopaedic Research Society, Orlando, FL, USA, (2016)
- **Sweetu B. Patel**, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, "Functionalization of TiO₂ nanotubes with Vitamin D to improve Electrochemical properties of Ti based implants," The American Prosthodontic Society, Chicago, IL, USA, (2016)
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, "Mechanically Strong TiO₂ Nanotubes for Hip Implants," 145th TMS Annual Meeting and Exhibition, Nashville, TN, USA, (2016)
- **Sweetu B. Patel**, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Craig Friedrich, Tolou Shokuhfar, " Optimization of Corrosion Resistive

Drug Loaded Surface," 145th TMS Annual Meeting and Exhibition, Nashville, TN, USA, (2016)

- **S. Patel**, G.F. Solitro, C. Sukotjo, C. Takoudis, M.T. Mathew, C. Friedrich, F. Amirouche, T. Shokuhfar, "Synergistic Effect of Mechanical and Electrochemical Impact on the Survivability of Nanotubes," 3rd IBTN Research Symposium, Chicago, IL, USA (2016)
- **Sweetu B. Patel**, Natalie Baker, Azhang Hamlekhan, Maria Runa, Cortino Sukotjo, Mathew T. Mathew, Christos G. Takoudis, Tolou Shokuhfar, "Novel Fabrication of Transparent Titania Nanotubes on Zirconia Bio-Implant," 144th TMS Annual Meeting and Exhibition, Orlando, FL, USA, (2015)
- **Sweetu B. Patel**, Maria Runa, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Tolou Shokuhfar, "Mechanical Stability of TiO₂ Nanotubes During Bio-Implant Insertion," Clinical Research Day at College of Dentistry, UIC, (2015)
- **Sweetu B. Patel**, Giovanni Francesco Solitro, Mathew T. Mathew, Farid Amirouche, Tolou Shokuhfar, "Is Nano-rough Topography a Solution for Enhanced and Stable Femoral Bone-Implant Interface In a Hip Implant?," Orthopaedic Research Society, Las Vegas, Nevada, USA (2015)
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Tolou Shokuhfar, "Mechanically Stable Titania Nanotubes For Improved Primary Stability of Implants," Rush Research Symposium, Rush University Medical Center, (2015)
- **Sweetu Patel**, Giovanni Francesco Solitro, Cortino Sukotjo, Christos Takoudis, Mathew T. Mathew, Farid Amirouche, Tolou Shokuhfar, "Anodized Ti6Al4V Surface Potentiates Improved Primary Stability for Implants," 1st Institute of Biomaterials, Tribocorrosion and Nanomedicine – US Research Symposium, Chicago, IL, USA, (2015)
- **Sweetu B. Patel**, Azhang Hamlekhan, Dmitry Royhman, Arman Butt, Judy Yuan, Tolou Shokuhfar, Cortino Sukotjo, Mathew T. Mathew, Gregory Jursich, Christos G. Takoudis, "Improving Ti-6Al-4V Alloy Surface Characteristics For Bio-implants Using Anodization And Thermal Oxidation," Clinical Research Day at College of Dentistry, UIC, 2014

- **Sweetu B. Patel**, Azhang Hamlekhan, Arman Butt, Dmitry Royhman, Christos G. Takoudis, Cortino Sukotjo, Tolou Shokuhfar, Mathew T. Mathew, “Enhancing surface characteristics of TiAl6V4 using thermal oxidation for dental implants,” Clinical Research Day at College of Dentistry, UIC, 2013
- **Sweetu Patel**, Arman Butt, Dmitry Rohyman, Jorge I. R. Agudelo, Cortino Sukotjo, Christos Takoudis, UIC Research Forum, “ Novel Functionalization of Ti-II and Ti-V Surfaces with Improved Cleaning and Storage Methods,” 2012

Affiliations/Memberships

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| • Reviewer of The Journal of Bio-Tribo-Corrosion | 2015-Present |
| • Student Representative in Society For Biomaterials, Orthopaedics | 2015-Present |
| • Member of The Minerals, Metals and Materials Society (TMS) | 2014-Present |
| • PhD candidate in Mechanical Engineering Department at MTU | 2013-2016 |
| • Researcher in Department of Bioengineering at UIC | 2011-Present |
| • Researcher in Department of Restorative Dentistry at UIC | 2012-Present |
| • Biomedical Engineering Society | 2011-2012 |
| • Bioengineering Organization Alliance | 2011-2012 |

Awards and Honors

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| • Best top four posters in Research Category, American Prosthodontic Society | 2016 |
| • 1 st place winner, Poster Presentation, 3 rd Institute of Biomaterials, Tribocorrosion and Nanomedicine, Chicago, IL, USA, 2016 | 2016 |
| • Outstanding Scholarship Award in Department of Mechanical Engineering, MTU | 2016 |
| • Poster Session Chair of “Advanced Materials in Dental and Orthopedic Applications,” 145 th TMS Annual Meeting and Exhibition, Nashville, TN, USA, 2016 | 2015- 2016 |
| • MTU Graduate student Travel Grant | 2015 |
| • Travel Grant Award, 145 th TMS Annual Meeting and Exhibition, Nashville, TN, USA | 2015 |
| • Travel Grant Award, 144 th TMS Annual Meeting and Exhibition, Orlando, FL, USA | 2015 |

- Poster Session chairing of “Advanced Materials in Dental and Orthopedic Applications,” 144th TMS Annual Meeting and Exhibition, Orlando, FL, USA, 2015