

Dr. Devendra Verma

Department of Biotechnology and Medical Engineering,
National Institute of Technology Rourkela, Odisha, PIN- 769008

Education

Doctorate of Philosophy: Materials and Nanotechnology

North Dakota State University, USA, Year: 2008

Dissertation topic: Materials design for Bone Tissue Engineering

Master of Technology: Materials Science and Engineering

Indian Institute of Technology, Bombay, INDIA, Year: 2003

Thesis topic: Experimental investigation of magnetic and transport properties of colossal magnetoresistive materials.

Bachelor of Engineering: Ceramic Engineering

National Institute of Technology, INDIA, Year: 2001

Awards

Researcher of the Year, College of Engineering and Architecture, North Dakota State University. 2007

Graduate School Doctoral Dissertation Fellowship, North Dakota State University. 2007

EPSCoR Travel Award for attending Materials Research Society conference. 2005

EPSCoR Travel Award for attending Materials Research Society conference. 2004

Research Experience

Post-doc, Dept. of Biomedical Engineering, Rutgers, 2009-2013

Biomaterials for Anti-Adhesion Barriers

1. Hydrogels as Scaffolds to Bridge Axons for Spinal Cord Injuries
2. Differentiation of mESCs into Osteoblast cells for Bone Tissue Engineering
3. Cell Derived Matrix for MSCs Based Therapy

Ph.D., Dept., NDSU, 2003-2009

1. Biomimetic Bone Tissue Engineering
2. Spectroscopic Study of Nacre
3. Materials for Spintronics Applications

Product Development and Entrepreneurial Activities

1. **SotopBleed** – A hemostatic agent for severing bleeding
 - Technology won 1st prize in Birla Global Innovation Challenge held in Delhi, 2020
 - Technology Won ‘Dare to Dream’ Challenge organized by DRDO in hemostatic category, 2019
 - Technology won 2nd Prize in MassChallenge Competition held in Jerusalem, Israel and Boston, USA, 2019
 - Supported by BIRAC’s BIG grant, 2019
 - Supported by NIDHI PRAYAS, DST, 2018
 - Cofounded Miraqules Medsolutions Pvt. Ltd. in 2018 to commercialize StopBleed
2. **AlboGel** – An injectable hydrogel for prevention of abdominal adhesions
 - Supported by BIRAC’s BIG grant, 2020
 - Cofounded Envision MedTech Pvt. Ltd., 2020 to commercialize AlboGel.
3. **HyGel** –Non-adherent wound dressings for pain-free removal

Sponsored Research Projects

Sl. No.	Name of the Project	Sponsoring Agency	Start Date	Close Date
1	Development of an injectable hemostatic device for non-compressible hemorrhage (Approved)	DHR	2021	2024
2	Fast clotting clinical grade hemostatic agent for emergency care	IMPRINT, SERB	2019	2022
3.	Development of high wet strength scaffolds for bone tissue engineering	Nano Mission, DST	2015	2018

Publications

Patents

1. Injectable hydrogel for prevention of post-surgical adhesions, to be filed
2. Fibrous polymeric scaffold compositions, preparation method, and an application thereof, Application no. 202131022332, Filed in May 2021.
3. Self-assembled nano-fibers as hemostatic agent. Application No. 201931015575, Devendra Verma, Sabir Hossain, NIT Rourkela, Filed 17 Apr 2019.
4. Nano-fibrous polyelectrolyte complex for rapid control of haemorrhage.

Application no. 201831026577, Devendra Verma, Sabir Hossain, NIT Rourkela, Filed 17 Jul 2018.

5. Biomaterial and Methods of Use Thereof for the Prevention of Post- operative Adhesions, Patent No. 9,757,499, Noshir Langrana, Devendra Verma, Michelle Previtera, Rutgers University, Granted 12 Sep 2017.
6. Composites and methods of preparation and use thereof, Publication number: 20080181926.

Book chapters

1. Bharadwaj, T., Thomas, A. & Verma, D. Bioprinting. Appl. 3D Print. Biomed. Eng. 45–96, 2021.
2. Wasupalli Geeta Kumari, “Polysaccharides as Biomaterials” Woodhead Publishing 2018.
3. M. Buriuli, “Polyelectrolyte Complexes (PECs) for Biomedical Applications” in Advances in Biomaterials for Biomedical Applications by Springer, 2016.
4. F. X. Jiang, B. Yurke, D. Verma, M. Previtera, R. Schloss and N. A. Langrana “Development of DNA Based Active Macro-3 Materials for Biology and Medicine: A Review” in Biomaterial / Book 2 by InTech, 2011.
5. K. S. Katti and D. Verma, D. Katti, Chapter on “Characterizing Biointerfaces and Biosurfaces in Biomaterials Design” in ‘Nanoscience in Biomedicine’ by Springer, 2009.
6. K. S. Katti and D. Verma, D. Katti, Chapter on “Materials and engineering of joint replacement” in Joint replacement technology: New Developments by Woodhead Publishers, 2008.

Journal Articles

1. Mishra, B., Hossain, S., Mohanty, S., Gupta, M. K. & Verma, D. Fast acting hemostatic agent based on self-assembled hybrid nanofibers from chitosan and casein. Int. J. Biol. Macromol. 185, 2021 525–534.
2. Hossain, S., Mohanty, S. & Verma, D. Polyelectrolyte complex based nanofibrous aggregates for fast hemostasis. Mater. Today Commun. 27, 2021, 102364.
3. Bharadwaj, T. & Verma, D. Open source bioprinters: Revolutionizing the accessibility of biofabrication. Bioprinting 23, 2021, e00155.
4. G. K. Wasupalli and D. Verma, Injectable and thermosensitive nanofibrous hydrogel for bone tissue engineering, Materials Science and Engineering and C, 107, 2020, 110343-110353.
5. G. K. Wasupalli and D. Verna, Molecular interactions in self-assembled nano-structures of chitosan-sodium alginate-based polyelectrolyte complexes. Int J Biol Macromol. 114, 2018, 10-17.
6. M. Buriuli, D. Verma, Polyelectrolyte complex based bandages for hemorrhage control. Journal of Biomaterials Applications, 32, 2017, 638–647.

7. M.L. Previtera, M. Hui, D. Verma, A.J. Shahin, R. Schloss, N.A. Langrana, *Anal. Of Biomedical Engineering, The Effects Of Substrate Elastic Modulus On Neural Precursor Cell Behavior.* 41, 2013, 1193-11207.
8. D. Verma., M. Previtera, R. Schloss and N. Langrana, *Biomaterials for Prevention of Post-Surgical Adhesions in Neurosurgery. Annals of Biomedical Engineering,* 40, 2012, 1949-1960.
9. J.F. Cherry, A.L. Carlson, F. L. Benarba, S.D. Sommerfeld, D. Verma, G. Loers, J. Kohn, M. Schachner and P. V. Moghe. *Oriented, Multimeric Biointerfaces of the L1 Cell Adhesion Molecule: An Approach to Enhance Neuronal and Neural Stem Cell Functions on 2-D and 3-D Polymer Substrates. Biointerphases,* 7, 2012, 1-16.
10. D. Verma, M. Desai, N. Kulkarni, N. Langrana, *Characterization of Surface Charge and Mechanical Properties of Chitosan/Alginate based Biomaterials. Materials Science and Engineering: C,* 31, 2011, 1741- 1747.
11. M. Previtera, K. Trout, D. Verma, U. Chippada, R. Schloss and N. A. Langrana *Fibroblast Morphology on Dynamic Softening of Hydrogels, Accepted for publication in Annals of Biomedical Engineering,* Nov. 2011.
12. D. Verma, K. Katti, D. Katti, *Osteoblast adhesion, proliferation and growth on polyelectrolyte-hydroxyapatite nanocomposites. Philosophical Transaction of the Royal Society: A,* 368, 2010, 2083-2097.
13. D. Verma, K. Katti, D. Katti, *Polyelectrolyte-complex nanostructured fibrous scaffolds for tissue engineering, Materials Science and Engineering: C,* 29, 2009, 2079- 2084.
14. D. Verma, K. Katti, D. Katti, *Interfacial interactions and effect of biopolymer on structure of hydroxyapatite in biomimetic nanocomposites, Annals of Biomedical Engineering,* 38, 2008, 1024-1032.
15. D. Verma, K. Katti, D. Katti and B. Mohanty, *Mechanical response and multilevel structure of biomimetic hydroxyapatite/biopolymer nanocomposites, Materials Science and Engineering C,* 28, 2008, 399-405.
16. D. Verma, K. Katti, D. Katti, *Experimental investigation of interfaces in hydroxyapatite/polyacrylic acid/polycaprolactone composites using photoacoustic FTIR spectroscopy, Journal of Biomedical Materials Research Part A,* 77A, 2006, 59-66.
17. D. Verma, K. Katti, D. Katti, *Bioactivity in in situ polycaprolactone-hydroxyapatite composites, Journal of Biomedical Materials Research Part A,* 78A, 2006, 772-780.
18. D. Verma, K. Katti, D. Katti, *Nature of water in nacre: A 2d Fourier transform infrared spectroscopic study, Spectrochimica Acta A: Molecular and Biomolecular Spectroscopy,* 67, 2007, 784-788.
19. D. Verma, K. Katti and D. Katti, *Photoacoustic FTIR spectroscopic study of undisturbed nacre from red abalone, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy,* 64, 2006, 1051-1057.
20. D. Verma, R. Dash, K. Katti, Doug Shultz, Anthony N. Karuso, *Orientations of Phthalocyanine on gold substrate using grazing angle Fourier transform infrared spectroscopy, Spectrochimica Acta,* 70A, 2008, 1180- 1187.

21. D. Verma, A. K. Nigam , T. K. Gundu Rao and D. Bahadur. Magnetic and transport studies in $\text{La}_{1-x}\text{Ca}_x\text{Mn}_{0.7}\text{Co}_{0.3}\text{O}_3$ ($0.1 \leq x \leq 0.5$), Journal of Magnetism and Magnetic Materials, 271, 2004, 172-179.
22. K. S. Katti, P. Turlapati, D. Verma, R. Bhowmik, P. K. Gujjula, and D. R. Katti. Static and dynamic mechanical behavior of hydroxyapatite-polyacrylic acid composites under simulated body fluid. American Journal of Biochemistry and Biotechnology, 2 (2), 2006, 73-79.
23. B. Mohanty, K. Katti, D. Katti, D. Verma, Dynamic nanomechanical response of nacre, Journal of Materials Research, 21, 2006, 2045-2051.
24. K. S. Katti, D. Sikdar, D. R. Katti, Pijush Ghosh and D. Verma, Molecular interactions in intercalated organically modified clay and clay–polycaprolactam nanocomposites: Experiments and modeling, Polymer, 47, 2006, 403-414.
25. R. Bhowmik, K. S. Katti, D. Verma, D. R. Katti, Probing molecular interactions in bone biomaterials: Through molecular dynamics and Fourier transform infrared spectroscopy. Materials Science and Engineering C, 27, 2007, 352-371.

Conference proceedings papers

1. V. Shah, D. Verma, M. Previtera, R. Schloss, N. Langrana. Development of a 3-Dimensional In-vitro Model Mimicking Peritoneum Fibrosis. Proceedings of the 43rd Annual Biomedical Engineering Society Conference, Atlanta, GA, 2012.
2. D. Verma, N. Kulkarni, V. Shah, M. Previtera, R. Schloss, N. Langrana, Biomaterials for Prevention of Post-Surgical Adhesions in Neurosurgery. Proceedings of the 42nd Annual Biomedical Engineering Society Conference, Hartford, CN, 2011.
3. M. Previtera, M. Hui, M Desai, D. Verma, R. Schloss, N Langrana. Neuronal Precursor Cell Proliferation on elastic Substrate. Proceedings of ASME SBC Conference, Farmington, PA, June 2011.
4. R. Kleiman, M. Previtera, S. Parikh, D. Verma, R Schloss, N Langrana. The Effects of Extracellular Matrix Proteins and Stiffness on Neuronal Cell Adhesion. Proceedings of ASME SBC Conference, Farmington, PA, June 2011.
5. M. Previtera, M. Hui, M. Desai, D. Verma, R. Schloss, N Langrana. The Effects of Substrate Rigidity on Neuronal Precursor Cells. Biomedical Engineering Society Annual Meeting. Austin, TX, 2010
6. M. Desai, N. Kulkarni, D. Verma, M. Previtera, R. Schloss, N. Langrana. Differentiation of mESCs into Osteoblasts using Chitosan-Alginate Based Polyelectrolyte Complexes. Biomedical Engineering Society Annual Meeting. Austin, TX, 2010.
7. U. Chippada, X. Jiang, D. Verma, B. Yurke, N. Langrana. Characterizing the mechanical response of DNA crosslinked hydrogels under physiological conditions. Proceedings of MRS Conference, Boston, MA, 2009
8. D. Verma, K. Katti, D. R. Katti. Biopolymer polyelectrolyte complex-

hydroxyapatite composites for bone tissue engineering. Proceedings of Materials Research Society, Fall 2006, meeting Symposium DD, Materials Research Society, Boston, MA.

9. B. Mohanty, D. Verma, K. S. Katti and D. R. Katti, Time Dependent Nanomechanical Properties of Nacre, Proceedings of Materials Research Society, Fall 2006, meeting Symposium DD, Materials Research Society, Boston, MA.
10. K. Katti, D. Verma, R. Bhowmik, D. Katti, Bioactivity and mechanical behavior of polymer-hydroxyapatite composite biomaterials for bone tissue engineering. Proceedings of ASME International Conference on Manufacturing Science and Engineering. 2006
11. D. Verma, R. Bhowmik, B. Mohanty, D. R. Katti and K. Katti, Role of interfacial interactions on mechanical properties of biomimetic composites for bone tissue engineering. Proceedings of Materials Research Society, Fall 2005, Materials Research Society, Boston, MA.
12. P. Ghosh, D. Verma, B. Mohanty, S. Pradhan, A. Bhosle, K. Katti and D. R. Katti, Mechanical properties of biological nanocomposite nacre: multiscale modeling and experiments on nacre from red abalone. Proceedings of Materials Research Society, Fall 2005, Materials Research Society, Boston, MA.
13. D. Verma, K. S. Katti, and B. Mohanty, Mechanical properties of biomimetic composites for bone tissue engineering. Proceedings of Materials Research Society, Fall 2004, meeting Symposium Y, Materials Research Society, Bonton, MA.

Presentations

1. Biomaterials for Prevention of Post-Surgical Adhesions in Neurosurgery. Proceedings of the 42nd Annual Biomedical Engineering Society Conference, Hartford, CN, 2011.
2. Biopolymer Polyelectrolyte Complex Nanocomposites for Bone Tissue Engineering. ASME Bioengineering Conference, June 17-21, 2009, Lake Tahoe, CA.
3. Biomaterials for Bone Tissue Engineering, August 3, 2008, NDSU, Fargo, ND.
4. Biopolymers Influence Structure and Mechanics of Hydroxyapatite Through Interfacial Interactions In Hydroxyapatite/Biopolymer. Inaugural International Conference of the Engineering Mechanics Institute, May 18-21, 2008, Minneapolis, Minnesota,
5. Role of Biopolymers on the Crystal Structure and Growth of Hydroxyapatite in Biopolymer/Hydroxyapatite Nanocomposite
6. Bone Biomaterials. Materials Research Society, Fall 2007, Boston, MA, USA.

7. Synthesis and Characterization of Novel Biopolymer/Hydroxyapatite Fibers for Bone Tissue Engineering. Materials Research Society, Fall 2007, Boston, MA, USA. (Poster Presentation)
8. Biopolymer polyelectrolyte complex-hydroxyapatite composites for bone tissue engineering. Materials Research Society, Fall 2006, Boston, MA, USA.
9. Controlling mechanical behavior in hydroxyapatite-chitosan composites for bone tissue engineering, Materials Science & Technology, 2006, Cincinnati, OH, USA.
10. Role of interfacial interactions on mechanical properties of biomimetic composites for bone tissue engineering. Materials Research Society, Fall 2005, Boston, MA, USA.
11. Mechanical properties of biomimetic composites for bone tissue engineering. Materials Research Society, Fall 2004, Boston, MA, USA (poster presentation).

Professional Activities

Paper Reviewer for Following Journals:

-Biomaterials, Acta Biomaterialia, Polymer Engineering & Science Vibrational Spectroscopy, Materials Science and Engineering C.

Co-Chair, Mechanoregulation of Bone - A Tribute to Rik Huiskes, Summer Bioengineering Conference, ASME, 2011

President of NDSU student chapter of materials Research Society, Jan. 2006- Dec. 2007

(This chapter won MRS chapter challenge competition in 2005 and was runner-up in 2006)

Served as a judge for North Dakota State Science fair competition (2007).

Served as a panelist (invited) in a panel discussion organized by NDSU, Graduate School for incoming graduate students (2007).

Professional Memberships

- Materials Research Society (MRS), 2003-2009
- The Minerals, Metals & Materials Society (TMS), 2004-2005.
- Biomedical Engineering Society (BMES), 2010-2011.