

Dr. Vikas Mittal

Personal Information

Date of birth: 21st March, 1979

Work Address: Chemical Engineering Department, The Petroleum Institute, Abu Dhabi

Phone: +971 509467032

E-mail: vmittal@pi.ac.ae

Academic Qualifications

Ph.D. (Doktor der Wissenschaften, Materials and Chemical Engineering)

Supervisors: Professor Dr. M. Morbidelli and Professor Dr. U. W. Suter

July 2006

Department of Materials

Swiss Federal Institute of Technology Zurich (ETH), Zurich, Switzerland.

M. Tech. (Master of Technology, Polymer Science and Technology)

Supervisors: Professor Dr. J. Bijwe and Professor Dr. S. N. Maiti

December 2001

Centre of Polymer Science and Engineering

Indian Institute of Technology Delhi (IIT), Delhi, India.

CGPA: 9.5/10

B. Tech. (Bachelor of Technology, Chemical Engineering)

May 2000

Department of Chemical and Bioengineering

Beant College of Engineering and Technology

Punjab Technical University (PTU), Punjab, India.

% aggregate: 83%

Senior Secondary Education (11th and 12th standard of Indian education system)

May 1996

Government Mahendra College

Punjabi University (PU), Punjab, India.

% aggregate: 72%

High School (10th standard of Indian education system)

April 1994

Modern Senior Secondary School, Punjab, India

% aggregate: 85%

Research and Teaching Experience

Current Employment as Assistant Professor, Chemical Engineering Department, The Petroleum Institute, Abu Dhabi, UAE (August 2010 till date)

At The Petroleum Institute, I am currently involved in the teaching of undergraduate and graduate courses e.g. Polymer Properties, Polymer Processing, Introduction to Polymer Science and Technology, Fluid Mechanics, Research Topics, Fundamentals of Nanotechnology, Summer Internship etc. Apart from that, I am also leading a Gas Research Centre (funded by Shell) project on the development of anti-corrosion self-healing coatings using polymers as matrices. Other research activities undertaken through Ph.D., graduate and undergraduate students are on the subjects of generation of soft materials based oil sensors and bio-degradable polymer nanocomposites (through internally funded projects) etc.

Laboratory Head (Engineer) at BASF SE, Germany (February 2008 – August 2010)

At BASF, I was responsible for the Colloid Physics Laboratory in the Polymer Research department of BASF SE in Germany. This function included the responsibilities like research on physical aspects of polymer colloids (dispersions), inorganic suspensions and organic-inorganic hybrid nanocomposites, thus, achieving insights into the molecular properties of the colloidal materials. The other responsibilities included project and team management by leading various cross-functional teams. I worked in strong collaborations with various universities in Europe and USA on the subjects of colloid research. The job also required the communication of the scientific developments internally as well as in international conferences externally. Apart from that, new findings of importance to the community were published in the scientific journals. I was also responsible for overseeing trainings, project work and visits of the Master and Ph.D. students from various universities in the Colloid Physics Laboratory.

Materials Scientist at SunChemical Europe, UK (October 2006 - February 2008)

The professional functions in my employment at SunChemical at London included research on active and intelligent polymer coatings and more specifically on gas barrier coatings for packaging applications by using the nanotechnology techniques developed in the recent years. The other functions involved the interaction with industrial customers, attending scientific exhibitions, project management and work breakdown structuring of the projects for easy commercial application of the research.

During my stay at SunChemical, I was successful in developing novel polymer coating technologies incorporating silicate solutions and aluminosilicate particles in the polymer solutions and emulsions. This resulted in the generation of ultra-high barrier to oxygen which can significantly increase the shelf life of the food and can avoid extensive food wastage. The experimental results were also supported by the statistical and optimization models. It has, thus, culminated into two patent applications on these high barrier coatings.

Post-Doctoral Researcher at ETH Zurich, Switzerland

Supervisor: Professor Dr. M. Morbidelli

In my short-period (3 months) post-doctoral research, I worked on the generation of the functional monoliths (porous macroporous materials) by physical aggregation and chemical gelation of polymer colloidal particles. Various factors affecting the performance of these monoliths for applications like chromatographic separation supports were optimized. Additionally, smart macro-surfaces with reversible thermal behavior (i.e. hydrophobic at high temperature and hydrophilic at low temperature) were also developed by the adsorption of polymer particles on the surface followed by further surface modification.

Ph.D. scholar at ETH Zurich, Switzerland

Thesis title: *Organic modifications of clay and polymer surfaces for specialty applications*

Supervisors: Professor Dr. M. Morbidelli and Professor Dr. U. W. Suter

During my Ph.D., I was involved in the development of advanced soft materials with special properties and subsequent applications as compared to the presently available materials. Specifically, I worked on the property enhancement of polymer matrices to be used in packaging and separation industries.

Inorganic surfaces of nano-fillers (like clay) were organically modified and were used to reinforce the polymer matrices like polyurethane, epoxy and polyolefins. Filler-matrix interactions and their effect on the mechanical and gas barrier properties of these polymer-clay nanocomposites to be used in packaging laminates were studied. By optimizing the filler-matrix interface, much better filler dispersion and hence composite properties were achieved and these enhancements could even be obtained in polyolefin matrices like polypropylene, which otherwise are difficult to achieve. The comparison of experimental results with simulation models (finite element models, micro-mechanical models, design of experiments etc.) also helped to predict the average aspect ratio of clay platelets in the composite materials. Polymerization, esterification and physical adsorption reactions on the clay surface could also be successfully performed to achieve shear-induced delamination of the filler in the polymer matrices for generating ideal polymer nanocomposites. Enhanced thermal stability of the nanocomposites was also achieved by the development of thermally stable filler modifications.

Surface properties of the colloidal polymer nanoparticles were also modified to provide environmental sensitivity to them so as to use them for temperature-controlled adsorption and desorption of biological media as well as for other chromatographic separations. The polymer particles were modified with living atom transfer radical polymerization (ATRP) initiators to subsequently graft high density thermally-responsive polymer brushes from the surface.

Various characterization techniques like TGA, DSC, X-ray, UV, SEM, TEM, IR etc.

were employed to ascertain the physical state of the systems. During these processes, different techniques of polymerization like free radical emulsion polymerization, nitroxide mediated living polymerization and atom transfer radical polymerization etc. were used in bulk or solution.

M. Tech. Major Project at IIT Delhi, India

Thesis title: *Influence of abrasives on the performance of non-asbestos brake materials*

Supervisors: Professor Dr. J. Bijwe and Professor Dr. S. N. Maiti

The work included the compounding of the various constituents of the modified asbestos-free brake formulation based on phenolic resin to manufacture brake pads similar to commercially used pads. These pads were then tested for their wear, abrasion and mechanical performance and the amount of abrasive like quartz and flint was optimized from the obtained results. Visits to many commercial installations were carried out to gain insight into the process.

Internships and Courses

- Two-month internship at General Electric India Technology Centre (JFWTC), Bangalore, India (June-July, 2001) and carried out a project with title: *Study of structure property relations and ductile to brittle balance of Ultem polymer.*
- Five week internship at Steel Authority of India Limited (SAIL), Bokaro, India (May-June, 1998).
- Five week internship at Amrit Banaspati Company Limited, Punjab, India (May-June, 1999). Project title: *Design of a shell and tube condenser for cooling the oil stream.*
- Participated in 28th Annual Short Course ‘Advances in Emulsion Polymerization and Latex Technology’ organized by Lehigh University, Pennsylvania and University of Maryland, Maryland in Davos, Switzerland (August 7-11, 2006).

Achievements & Awards

- 2nd rank in the university in the Master of Technology degree.
- Awarded Gold Medal and Merit Certificate for the 1st position in the university in the Bachelor of Technology degree.
- Scholarships during the Bachelor of Technology studies for the first rank in the university in all the semesters.
- ‘Best Student Award’ and ‘Most Outstanding Student Award’ during the Bachelor of Technology studies.
- Awarded second prize for the best oral presentation in the national level seminar on waste water treatment at Government Engineering College Ludhiana, India during the Bachelor of Technology program.

- Scholarship and Merit Certificate from the Punjab Government after the 10th standard under ‘National Scholarship Scheme’.
- Awarded certificates for participation in Pre-Senior and Senior UNESCO Information Test as well as United Nations Knowledge and Intelligence Test organized by United Schools Organization.

Skills

- English, German and Hindi language proficiency.
- Professional Six Sigma Black Belt (5 week Design for Six Sigma course) for quality improvement of the processes.
- Extensively trained for project management and operating allied softwares.
- Well versed with Microsoft and Mac operating systems and softwares along with other special packages like WinEdt, LaTeX, Minitab, Microsoft Projects, Corel Draw, Photoshop etc.
- Scientific operating capabilities of experimental techniques like TGA, DSC, X-ray, SEM, TEM, IR, UV, Tensile Testing, Abrasion and Wear Testing etc.

RESEARCH

A. Journal Publications (peer reviewed)

Total citations (as of 20th February 2012 in Scopus): 357

h-index (as of 20th February 2012 in Scopus): 9

(The superscript ^c in the list below signifies role as corresponding author)

2003

1. M. A. Osman, V. Mittal, M. Morbidelli, U. W. Suter. Polyurethane Adhesive Nanocomposites as Gas Permeation Barrier. *Macromolecules*, 2003, 36(26), 9851-9858. (impact factor: 4.838)

2004

2. M. A. Osman, V. Mittal, H. R. Lusti. The Aspect Ratio and Gas Permeation in Polymer – Layered Silicate Nanocomposites. *Macromolecular Rapid Communications*, 2004, 25(12), 1145-1149. (impact factor: 4.371)
3. M. A. Osman, V. Mittal, M. Morbidelli, U. W. Suter. Epoxy – Layered Silicate Nanocomposites and their Gas Permeation Properties. *Macromolecules*, 2004, 37(19), 7250-7257. (impact factor: 4.838)

2007

4. V. Mittal, N. B. Matsko, A. Butte, M. Morbidelli. Functionalized Polystyrene Latex Particles as Substrates for ATRP: Surface and Colloidal Characterization. *Polymer*, 2007, 48(10), 2806-2817. (impact factor: 3.828)

5. V. Mittal^c. Polymer Chains Grafted 'to' and 'from' the Layered Silicate Clay Platelets. *Journal of Colloid and Interface Science*, 2007, 314, 141-151. (impact factor: 3.066)
6. M. A. Osman, V. Mittal, U. W. Suter. Poly(propylene) – Layered Silicate Nanocomposites: Gas Permeation Properties and Clay Exfoliation. *Macromolecular Chemistry and Physics*, 2007, 208 (1), 68-75. (impact factor: 2.437)
7. V. Mittal^c. Gas Permeation and Mechanical Properties of Polypropylene Nanocomposites with Thermally-Stable Imidazolium Modified Clay. *European Polymer Journal*, 2007, 43, 3727-3736. (impact factor: 2.517)
8. V. Mittal^c. Esterification Reactions on the Surface of Layered Silicate Clay Platelets. *Journal of Colloid and Interface Science*, 2007, 315, 135-141. (impact factor: 3.066)
9. V. Mittal^c. Polypropylene-Layered Silicate Nanocomposites: Filler Matrix Interactions and Mechanical Properties. *Journal of Thermoplastic Composite Materials*, 2007, 20, 575-599. (impact factor: 0.865)
10. V. Mittal, N. B. Matsko, A. Butte, M. Morbidelli. Synthesis of Temperature Responsive Polymer Brushes from Polystyrene Latex Particles Functionalized with ATRP Initiator. *European Polymer Journal*, 2007, 43, 4868-4881. (impact factor: 2.517)

2008

11. V. Mittal^c. Mechanical and Gas Permeation Properties of Compatibilized Polypropylene – Layered Silicate Nanocomposites. *Journal of Applied Polymer Science*, 2008, 107, 1350-1361. (impact factor: 1.240)
12. V. Mittal, N. B. Matsko, A. Butte, M. Morbidelli. Swelling/Deswelling Behavior of PS-PNIPAAm Copolymer Particles and PNIPAAm Brushes Grafted from Polystyrene Particles & Monoliths. *Macromolecular Materials and Engineering*, 2008, 293, 491-502. (Cover Page also) (impact factor: 1.916)
13. V. Mittal, N. B. Matsko, A. Butte, M. Morbidelli. PNIPAAm Grafted Polymeric Monoliths Synthesized by Reactive Gelation Process and Their Swelling Deswelling Characteristics. *Macromolecular Reaction Engineering*, 2008, 2, 215-221. (impact factor: 1.701)
14. V. Mittal^c. Modeling the Behavior of Polymer-Layered Silicate Nanocomposites using Factorial and Mixture Designs. *Journal of Thermoplastic Composite Materials*, 2008, 21, 9-26. (impact factor: 0.865)
15. V. Mittal^c. Effect of the Presence of Excess Ammonium Ions on the Clay Surface on Permeation Properties of Epoxy Nanocomposites. *Journal of Materials Science*, 2008, 43, 4972-4978. (impact factor: 1.859)
16. V. Mittal^c. Epoxy-Vermiculite Nanocomposites as Gas Permeation Barrier. *Journal of Composite Materials*, 2008, 42, 2829-2839. (impact factor: 0.971)

17. V. Mittal^c, V. Herle. Physical Adsorption of Organic Molecules on the Surface of Layered Silicate Clay Platelets: A Thermogravimetric Study. *Journal of Colloid and Interface Science*, 2008, 327, 295-301. (impact factor: 3.066)

2009

18. V. Mittal^c, N. B. Matsko. PNIPAAm Grafted Particle Monoliths: Parameters Affecting Structure and Morphology. *Journal of Porous Materials*, 2009, 16, 537-543. (impact factor: 0.984)
19. V. Mittal^c (Invited Contribution). Advances in Achievement of Interfacial Compatibility and Organic-Inorganic Phase Mixing in Polymer Nanocomposites, *Nanotechnology Research Journal*, 2009, 2(1/2), 73-98.
20. V. Mittal^c, N. B. Matsko (Invited Contribution). New Method to Generate Reversible Hydrophobic and Hydrophilic Surfaces. *Open Surface Science Journal*, 2009, 1, 7-12.
21. V. Mittal^c. Polypropylene Nanocomposites with Thermally-Stable Imidazolium Modified Clay: Mechanical Modeling and Effect of Compatibilizer. *Journal of Thermoplastic Composite Materials*, 2009, 22, 453-474. (impact factor: 0.865)
22. V. Mittal^c. Polymer Layered Silicate Nanocomposites: A Review (Invited Contribution). *Special issue 'Composite Materials', Materials Journal*, 2009, 2(3), 992-1057.
23. V. Mittal^c. Clay Exfoliation in Polymer Nanocomposites: Specific Chemical Reactions and Exchange of Specialty Modifications on Clay Surface (invited Contribution). *Special issue 'Layered Silicate Materials', Philosophical Magazine*, 2009, 90(17/18), 2489-2506. (impact factor: 1.302)
24. V. Mittal^c. Characterization of Advanced Morphologies in Polymer Dispersions by Analytical Ultracentrifugation (AUC) and Hydrodynamic Chromatography (HDC). *Colloid and Polymer Science*, 2009, 288(1), 25-35. (impact factor: 2.443)

2010

25. V. Mittal^c. Synthesis of Environmentally Responsive Polymers by Atom Transfer Radical Polymerization: Generation of Reversible Hydrophilic and Hydrophobic Surfaces (invited Contribution). *Polymers*, 2010, 2(2), 40-56.
26. V. Mittal, A. Voelkel, H. Coelfen. Analytical Ultracentrifugation of Model Nanoparticles: Comparison of Different Analysis Methods. *Macromolecular Bioscience*, 2010, 10(7), 754-762. (Cover Page also) (impact factor: 3.458)
27. V. Mittal^c, M. D. Lechner. Size and Density Dependent Sedimentation Analysis of Advanced Nanoparticle Systems. *Journal of Colloid and Interface Science*, 2010, 346(2), 378-383. (impact factor: 3.066)
28. V. Mittal^c. Sedimentation Analysis of Organic-Inorganic Hybrid Colloids. *Colloid and Polymer Science*, 2010, 288(6), 621-630. (impact factor: 2.443)

29. V. Mittal^c. Permeation Properties of Castings of Epoxy and Polyurethane Layered Silicate Nanocomposites (Invited Contribution). *Nanotechnology Research Journal*, 2010, 3(3), 189-210.
30. V. Mittal^c. Grafting of Poly(Lauryl Methacrylate) From the Surface of Layered Silicates Using Oligomeric Azo-Initiators (Invited Contribution). *Polymer Research Journal*, 2010, 4(1), 43-57.

2011

31. V. Mittal^c, M. D. Lechner. Absorption and Interference Sedimentation Analysis of Bi -Component Polystyrene Solutions in Analytical Ultracentrifugation. *International Journal of Polymer Analysis and Characterization*, 2011, 16(2), 127-140. (impact factor: 0.814)
32. V. Mittal^c, M. D. Lechner. Size Distribution Analysis of Single and Bi-Component Polymer and Inorganic Particle Systems by Comparison of Two Analysis Methods in Analytical Ultracentrifuge. *Journal of Colloid and Interface Science*, 2011, 355(2), 423-430. (impact factor: 3.066)
33. M. D. Lechner, H. Cölfen, V. Mittal, A. Völkel, W. Wohlleben. Sedimentation Measurements with the Analytical Ultracentrifuge with Absorption Optics: Influence of Mie Scattering and Absorption of the Particles. *Colloid and Polymer Science*, 2011, 289(10), 1145-1155. (impact factor: 2.443)
34. V. Mittal^c, M. D. Lechner. Sedimentation Studies of Single and Bi -Component Polystyrene Solutions in Analytical Ultracentrifugation by Comparison of Two Analysis Methods: Effect of Polymer Concentration. *Polymer Bulletin*, 2011, 67(5), 831-841. (impact factor: 1.215)

2012

35. V. Mittal^c, M. D. Lechner. Sedimentation Studies of Bi -Component Polystyrene Solutions in Analytical Ultracentrifugation by Comparison of Two Analysis Methods: Effect of Polymer Mixing Ratios. *Polymer Bulletin*, 2012, 68(1), 167-179. (impact factor: 1.215)
36. V. Mittal^c. Polypropylene nanocomposites with thermally stable phosphonium- and pyridinium-modified layered silicates: Thermal, mechanical and gas barrier properties. *Journal of Thermoplastic Composite Materials*, 2012, doi: 10.1177/0892705711433439. (impact factor: 0.865)
37. V. Mittal^c. Modification of Montmorillonites with Thermally Stable Phosphonium Cations and Comparison with Alkylammonium Montmorillonites. *Applied Clay Science*, 2012, 56, 103-109. (impact factor: 2.303)
38. L. A. Fielding, O. O. Mykhaylyk, S. P. Armes, P. W. Fowler, V. Mittal, S. Fitzpatrick. Correcting for a Density Distribution: Particle Size Analysis of Core-Shell Nanocomposite Particles Using Disk Centrifuge Photosedimentometry. *Langmuir*, 2012, 28(5), 2536-2544. (impact factor: 4.269)

In Print

39. V. Mittal^c. Molecular Weight Distributions of Polymer Solutions: Combination of field flow fractionation (FFF) and analytical ultracentrifuge (AUC). *Journal of Dispersion Science and Technology*, in print.
40. V. Mittal^c, M. D. Lechner. Sedimentation Analysis of Polystyrene Macromolecules with Schlieren Optics. *Journal of Dispersion Science and Technology*, in print.
41. V. Mittal^c. Mechanical and Gas Barrier Properties of Polypropylene Layered Silicate Nanocomposites: A Review (Invited Contribution). *The Open Macromolecules Journal*, in print.
42. V. Mittal^c, A. U. Chaudhry, M. I. Khan. Comparison of anti-corrosion performance of polyaniline modified ferrites. V. Mittal, Ali Usman Chaudhry, *Journal of Dispersion Science and Technology*, in print.

Submitted

43. A. U. Chaudhry, V. Mittal^c. High density polyethylene nanocomposites using masterbatches of chlorinated polyethylene/graphene. *Polymer Engineering and Science*, submitted.
44. N. B. Matsko, V. Mittal. Topography of Organic Samples by Energy Filtered Transmission Electron Microscopy. *Nano Letters*, submitted.

B. Publications in Conference Proceedings

1. V. Mittal^c. Characterization of Morphology and Filler Exfoliation in Epoxy – Layered Silicate Nanocomposites. Proceedings of the 21st Annual Meeting of Polymer Processing Society, Leipzig, Germany, June 2005.

C. Patent Applications

1. Great Britain Patent Application with Title: Oxygen Barrier Coatings with Metal Silicates and Solution Acrylic Formulations.
Applicant: Sun Chemical Europe, UK.
Principal Investigators: D. Illsley, V. Mittal, A. Khan.
Filing Date: 9th March 2007.
2. Great Britain Patent Application with Title: Oxygen Barrier Coatings with Metal Silicates, Clay and Polymer Emulsion Formulations.
Applicant: Sun Chemical Europe, UK.
Principal Investigators: V. Mittal, D. Illsley, M. Leonard.
Filing Date: 11th September 2007.

D. Authored Books

1. Advances in Polymer Latex Technology, Nova Science Publishers, New York, USA, ISBN 978-1-60-741-170-3.

2. Novel Techniques of Microscopic Characterization of Soft Matter, Springer, Heidelberg, *in preparation*.

E. Selected Edited Books

1. Optimization of Polymer Nanocomposite Properties, Wiley VCH, Germany, 2010, ISBN: 978-3-527-32521-4.
2. Barrier Properties of Polymer Nanocomposites, Nova Science Publishers, New York, USA, 2010, ISBN 978-1-60876-021-3.
3. Advanced Polymer Nanoparticles: Synthesis and Surface Modification, Taylor and Francis (CRC Press), USA, 2010, ISBN 978-1-43981-443-7.
4. Advances in Polyolefin Nanocomposites, Taylor and Francis (CRC Press), USA, 2010, ISBN 978-1-43981-454-3.
5. Polymer Nanotube Nanocomposites: Synthesis, Properties and Applications, John Wiley, USA and Scrivener Publishing, USA, 2010, ISBN 978-0-47062-592-7.
6. Miniemulsion Polymerization Technology, John Wiley, USA and Scrivener Publishing, USA, 2010, ISBN 978-0-47062-596-5.
7. Polymer Nanocomposites by Emulsion and Suspension Polymerization, Royal Society of Chemistry, UK, 2010, ISBN 978-1-84755-225-9.
8. Thermally Stable and Flame Retardant Polymer Nanocomposites, Cambridge University Press, UK, 2011, ISBN 978-0-521-19075-6
9. Nanocomposites with Biodegradable Polymers: Synthesis, Properties and Future Perspectives, Oxford University Press, UK, 2011, ISBN 978-0-19-958192-4
10. Recent Advances in Elastomeric Nanocomposites, Springer, Germany, 2011, ISBN 978-3-642-15786-8
11. Surface Modification of Nanotube Fillers, Wiley VCH, Germany, 2011, ISBN 978-3-527-32878-9
12. High Performance Polymer and Engineering Plastics, John Wiley, USA and Scrivener Publishing, USA, 2011, ISBN 978-1-118-01669-5
13. In-Situ Synthesis of Polymer Nanocomposites, Wiley VCH, Germany, 2012, ISBN 978-3-527-32879-6.

F. Selected Book Chapters

1. Polymer Nanocomposites: Achievement of Interfacial Compatibility and Organic-Inorganic Phase Mixing, New Research on Nanocomposites, Editors: L. M. Krause and J. T. Walter, Nova Science Publishers, New York, USA, 2008, pp. 281-306.

2. Advances in Polymer-Layered Silicate Nanocomposites Technology, Novel Polymers and Nanoscience, Editor: M. Adeli, Research Signpost Publishers, India, pp. 73-92.
3. Barrier Resistance Generation in Polymer Nanocomposites, In: Optimization of Polymer Nanocomposite Properties, Editor: Vikas Mittal, Wiley VCH, Germany, 2010, pp. 173-193.
4. Functional Polymer Particles by Emulsifier-Free Polymerization, In: Advanced Polymer Nanoparticles: Synthesis and Surface Modifications, Editor: Vikas Mittal, Taylor and Francis (CRC Press), USA, 2010, pp. 307-328.
5. Polypropylene Nanocomposites with Clay Treated with Thermally Stable Imidazolium Modification, In: Advances in Polyolefin Nanocomposites, Editor: Vikas Mittal, Taylor and Francis (CRC Press), USA, 2010, pp. 265-284.
6. Structured Copolymer Particles by Miniemulsion Polymerization, In: Miniemulsion Polymerization Technology, Editor: Vikas Mittal, John Wiley, USA and Scrivener Publishing, USA, 2010, pp. 43-70.
7. Overview on Polymer Nanotube Nanocomposites, In: Polymer Nanotube Nanocomposites: Synthesis, Properties, and Applications, Editor: Vikas Mittal, John Wiley, USA and Scrivener Publishing, USA, 2010, pp. 15-44.
8. Emulsion and Suspension Polymerization Technology for Nanocomposite Synthesis, In: Polymer Nanocomposites by Emulsion and Suspension Polymerization, Editor: Vikas Mittal, Royal Society of Chemistry, UK, 2010, pp. 1-31.
9. Bio-nanocomposites: Future High Value Materials, In: Nanocomposites with Biodegradable Polymers, Editor: Vikas Mittal, Oxford University Press, UK, 2011, pp. 1-27.
10. Polymer Nanocomposites: Layered Silicates, Surface Modifications and Thermal Stability, In: Thermally Stable and Flame Retardant Polymer Nanocomposites, Editor: Vikas Mittal, Cambridge University Press, UK, 2011, pp. 1-28.
11. Elastomeric Clay Nanocomposites for Packaging, In: Advances in Elastomeric Nanocomposites, Editors: Vikas Mittal, Jin Kuk Kim, Kaushik Pal, Springer, Germany, 2011, pp. 231-254.
12. Carbon Nanotubes Surface modifications: An Overview, In: Surface Modification of Nanotubes, Editor: Vikas Mittal, Wiley VCH, Germany, 2011, pp. 1-23.
13. Functional Oligomeric Azo-Initiators for Grafting of Polymers on Clay Surface, In: Polymer Initiators, Editor Whitney J. Ackrine, Nova Science Publishers, USA, 2011, pp. 217-232.
14. Solvent Based Thermoset Polymer Clay Nanocomposite Castings for Gas Barrier Applications, In: Structural Steel and Castings: Shapes and Standards, Properties and Applications, Editor Lena M. Becker, Nova Science Publishers, USA, 2011, pp. 185-206.

15. In-Situ Synthesis and Properties of Epoxy Nanocomposites, In: In-Situ Synthesis of Polymer Nanocomposites, Editor: Vikas Mittal, Wiley VCH, Germany, 2012, pp. 221-244.

G. Ongoing and Past Research Projects

- Principal investigator of ongoing Gas Research Centre project ‘Surface Engineered Self-Healing Anti-Corrosion Polymer Coatings for Gas Pipelines and Storage Tanks’ (total funding of 0.7 million USD from Shell)
- Co-principal investigator of ongoing Gas Research Centre project ‘N₂ removal from Natural Gas’ (total funding of 1 million USD from Shell)
- Principal investigator of ongoing Petroleum Institute Research Initiation Funding project ‘Inverse Polymer Opals for Oil Sensors’ (total funding 0.1 million USD)
- Principal investigator of ongoing Petroleum Institute Research Initiation Funding project ‘Biodegradable Nanocomposites’ (total funding 0.1 million USD)
- Ongoing research collaborations with universities like Graz University, Austria (microscopic insights of soft materials), University of Guelph, Canada (bio-nanocomposites), University of Waterloo, Canada (simulation and optimization of nanocomposite properties) as well as industries like BASF, Germany (polymeric membranes for gas treatment, bio-nanocomposites), Well Plastics, UK (biodegradation of polymers) etc.
- Led/contributed to many projects in the area of Barrier Coatings, Structured Pigments, Polyelectrolyte Adsorption, Graphene Characterization, Macroporous Ceramics etc. during employment at BASF and SunChemical.
- Mini project at IIT Delhi with title: Optimization of dye content in polypropylene matrix to match the color with the commercial polypropylene crates.
- Mini project at IIT Delhi with title: Rheology, morphology and mechanical performance of polypropylene/polystyrene blends.
- Major project during B. Tech. with title: Design of a multicomponent distillation plant for the separation of a petroleum stream.
- Mini project during B. Tech. with title: Batch reactor design for the synthesis of phenol formaldehyde polymer.

H. Research Advising

- Thesis Supervisor of a Ph.D. (registered at Colorado School of Mines, USA) and a graduate student at the Chemical Engineering Department of The Petroleum Institute working in the area of polyolefin-graphene nanocomposites and anti-corrosion polymeric coatings. A post doctoral fellow would soon join to continue work on the self-healing polymeric coatings.

- Advisor of undergraduate students at the Chemical Engineering Department of The Petroleum Institute for ‘Research Topics in Chemical Engineering’ course
- A number of papers reviewed for journals like Journal of Colloid and Interface Science, Polymer, Journal of Materials Research, Polymer Engineering and Science, European Polymer Journal, Journal of Molecular Catalysis, Journal of Applied Polymer Science, Journal of Nanoparticle Research, Applied Clay Science, Colloids and Surfaces A: Physiochemical and Engineering Aspects, Polymer Bulletin, Journal of Materials Science etc.

I. New Research Initiated at The Petroleum Institute

- bio-nanocomposites of polyethylene and polypropylene
- polymer based oil sensors
- self-healing anti-corrosion coatings