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Professional Experience

- **Soft Nanomaterials Theory and Simulation Research Scientist** December 2012 -
Center for Nanophase Materials Sciences (CNMS),
Computer Science and Mathematics Division (CSMD),
Oak Ridge National Laboratory, Oak Ridge, TN
- **American Recovery and Reinvestment Act Fellow** July 2010-December 2012
Advisors: Bobby G. Sumpter and Ricky Kendall
National Center for Computational Sciences (NCCS),
Oak Ridge National Laboratory, Oak Ridge, TN
- **Post-doctoral Research Associate** September 2008-June 2010
Advisor: Prof. Glenn H. Fredrickson
Materials Research Laboratory (MRL),
University of California, Santa Barbara, CA
- **Lecturer (Mathematics)** 2002-2003
Career Point Inc., Kota, India
- **Intern** May-July 2001
Jagatjeet Cotton Textile (JCT) Ltd., India

Education

- **Ph.D. in Polymer Science & Engineering** 2004 -2008
Dissertation Title: Self-consistent field theory for polyelectrolytes and its applications
Advisor: Prof. M. Muthukumar
University of Massachusetts, Amherst, MA
- **M.S. in Polymer Science & Engineering** 2003-2004
University of Massachusetts, Amherst, MA
- **B.Tech. in Textile Technology** 1998-2002
Indian Institute of Technology, Delhi, India

Academic Honors/Activities

- Reviewer for research grant proposal submitted to the National Science Foundation (NSF) and the US-Israel Binational Science Foundation (BSF) 2014-Present
- Member of American Physical Society 2006-Present
- Reviewer for The Journal of Chemical Physics, New Journal of Physics, Macromolecules, European Polymer Journal E, Materials Chemistry and Physics, Advanced Energy Materials 2006-Present
- Jawahar Gajree Memorial Scholarship 2000-2001
- Award for social services from the National Service Scheme 1999-2000

Publications : Refereed Articles

1. N. Herath, S. Das, J. K. Keum, J. Zhu, **R. Kumar**, I. N. Ivanov, B. G. Sumpter, J. F. Browning, K. Xiao, G. Gu, P. Joshi, and V. Lauter, "Peculiarity of two thermodynamically-stable morphologies and their impact on the efficiency of small molecule bulk heterojunction solar cells," *Scientific Reports*, (in press).
2. J. Zhu, Y. Han, **R. Kumar**, Y. He, K. Hong, B. G. Sumpter, S. Smith, I. Ivanov and C. Do, "Controlling assembly of a water-soluble conjugated polymer ," *Nanoscale*, (2015) DOI: 10.1039/C5NR02037A.
3. J.Y. Carrillo, S. Cheng, **R. Kumar**, M. Goswami, A. P. Sokolov, and B. G. Sumpter, "Untangling the effects of chain rigidity on the structure and dynamics of strongly adsorbed polymer melts," *Macromolecules* **48**, 4207 (2015).
4. **R. Kumar**, B. S. Lokitz, S. W. Sides, J. Chen, W. Heller, J. F. Ankner, J. Browning, S. M. Kilbey II, and B. G. Sumpter, "Microphase separation in thin films of lamellar forming polydisperse di-block copolymers," *RSC Advances* **5**, 21336 (2015).
5. E. Strelcov, **R. Kumar**, V. Bocharova, B. G. Sumpter, A. Tselev, and S. V. Kalinin, "Nanoscale lubrication of ionic surfaces controlled via strong electric field," *Scientific Reports* **5**, 8049 (2015).
6. V. Bocharova, A. L. Agapov, A. Tselev, L. Collins, **R. Kumar**, S. Berdzinski, V. Strehmel, A. Kisliuk, I. I. Kravchenko, B. G. Sumpter, A. P. Sokolov, S. V. Kalinin, and E. Strelcov, "Controlled nanopatterning of a polymerized ionic liquid in a strong electric field," *Adv. Func. Mat.* **25**, 805 (2015).
7. **R. Kumar**, V. Bocharova, E. Strelcov, A. Tselev, I. I. Kravchenko, S. Berdzinski, V. Strehmel, O. S. Ovchinnikova, J. A. Minutolo, J. R. Sangoro, A. L. Agapov, A. P. Sokolov, S. V. Kalinin, and B. G. Sumpter, "Ion transport and softening in a polymerized ionic liquid," *Nanoscale* **7**, 947 (2015).
8. **R. Kumar**, B. G. Sumpter, and M. Muthukumar, "Enhanced phase segregation induced by dipolar interactions in polymer blends," *Macromolecules* **47**, 6491 (2014).
9. M. Shao, J. K. Keum, **R. Kumar**, J. Chen, J. F. Browning, S. Das, W. Chen, J. Hou, C. Do, K. C. Littrell, A. Rondinone, D. B. Geohegan, B. G. Sumpter, and K. Xiao, "Understanding how processing additives tune the nanoscale morphology of high efficiency organic photovoltaic blends: From casting solution to spun-cast thin film," *Adv. Func. Mat.* **24**, 6647 (2014).
10. J.Y. Carrillo, **R. Kumar**, M. Goswami, B.G. Sumpter, and W.M. Brown, "New insights into dynamics and morphology of P3HT:PCBM active layers in bulk heterojunctions," *Phys. Chem. Chem. Phys.* **15**, 17873 (2013).
11. C. Dyer, P. Driva, S.W. Sides, B.G. Sumpter, J. W. Mays, J. Chen, **R. Kumar**, M. Goswami, and M. Dadmun, "Effect of macromolecular architecture on the morphology of polystyrene - polyisoprene block copolymers," *Macromolecules* **46**, 2023 (2013).
12. **R. Kumar**, M. Goswami, B.G. Sumpter, V. Novikov, and A.P. Sokolov, "Effects of backbone rigidity on the local structure and dynamics in polymer melts and glasses," *Phys. Chem. Chem. Phys.* **15**, 4604 (2013).

13. K. Misichronis, S. Rangou, E. Ashcraft, **R. Kumar**, M. Dadmun, B.G. Sumpter, N.E. Zafeiropoulos, J.W. Mays, and A.T. Avgeropoulos, "Synthesis, characterization (molecular-morphological) and theoretical morphology predictions of linear triblock terpolymers containing poly(cyclohexadiene)," *Polymer* **54**, 1480 (2013).
14. **R. Kumar**, S.W. Sides, M. Goswami, B.G. Sumpter, K. Hong, X. Wu, T.P. Russell, S.P. Gido, K. Misichronis, S. Rangou, A.T. Avgeropoulos, T. Tsoukatos, N. Hadjichristidis, F. Beyer, and J.W. Mays, "Morphologies of ABC triblock terpolymer melts containing poly(cyclohexadiene) : effects of conformational asymmetry," *Langmuir* **29**, 1995 (2013).
15. **R. Kumar**, Y. Li, S.W. Sides, J.W. Mays, and B.G. Sumpter, "Morphology diagrams for A₂B copolymer melts: real-space self-consistent field theory," *J. Phys.: Conf. Ser.* **402**, 012042 (2012).
16. J.W. Mays, **R. Kumar**, S.W. Sides, M. Goswami, B.G. Sumpter, K. Hong, X. Wu, T. P Russell, S.P. Gido, A. Avgeropoulos, T. Tsoukatos, N. Hadjichristidis, and F. L. Beyer, "Morphologies of poly(cyclohexadiene) diblock copolymers: effect of conformational asymmetry," *Polymer* **53**, 5155 (2012).
17. **R. Kumar**, B.G. Sumpter, and S.M. Kilbey, "Charge regulation and local dielectric function in planar polyelectrolyte brushes," *J. Chem. Phys.* **136**, 234901 (2012).
18. X. Wang, M. Goswami, **R. Kumar**, B.G. Sumpter, and J.W. Mays, "Morphologies of block copolymers composed of charged and neutral blocks," *Soft Matter* **8**, 3036 (2012) (cover page).
19. R.A. Riggleman, **R. Kumar**, and G.H. Fredrickson, "Investigation of the interfacial tension of complex coacervates using field-theoretic simulations," *J. Chem. Phys.* **136**, 024903 (2012).
20. M. Goswami, **R. Kumar**, B.G. Sumpter, and J.W. Mays, "Breakdown of inverse morphologies in charged diblock copolymers," *J. Phys. Chem. B.* **115**, 3330 (2011).
21. **R. Kumar**, D. Audus, and G.H. Fredrickson, "Phase separation in symmetric mixtures of oppositely charged rodlike polyelectrolytes," *J. Phys. Chem. B.* **114**, 9956 (2010).
22. **R. Kumar** and M. Muthukumar, "Origin of translocation barriers for polyelectrolyte chains," *J. Chem. Phys.* **131**, 194903 (2009).
23. **R. Kumar** and G.H. Fredrickson, "Theory of polyzwitterion conformations," *J. Chem. Phys.* **131**, 104901 (2009).
24. **R. Kumar**, A. Kundagrami, and M. Muthukumar, "Counterion adsorption on flexible polyelectrolytes : comparison of theories," *Macromolecules* **42**, 1370 (2009).
25. **R. Kumar** and M. Muthukumar, "Confinement free energy of flexible polyelectrolytes in spherical cavities," *J. Chem. Phys.* **128**, 184902 (2008).
26. **R. Kumar** and M. Muthukumar, "Microphase separation in polyelectrolytic diblock copolymer melt : Weak segregation limit," *J. Chem. Phys.* **126**, 214902 (2007).

Conference Proceedings

27. **R. Kumar** and B.G. Sumpter, "Quantitative analysis of chain packing in polymer melts using large scale molecular dynamics simulations," in Proc. SciDAC 2011, Denver, CO, July 10-14, 2011, <http://press.mcs.anl.gov/scidac2011/>

28. M. Jassal, V. Raj, **R. Kumar**, N.S. Save, and A.K. Agrawal, "Synthesis of stimuli-sensitive polymers based on N-substituted acrylamides," *Proceedings of International Seminar on Frontiers of Polymer Science and Engineering*, MACRO , IIT Kharagpur, December 2002, 09.4.

Book Chapter : Invited Contributions

29. **R. Kumar**, J. Carrillo, M. Goswami, and B. G. Sumpter, "Insights obtained from modeling of organic photovoltaics: morphology, interfaces and coupling with charge transport," in "Organic Solar Cells: Materials, Devices, Interfaces, and Modeling," edited by Q. Qiao, CRC Press, Taylor and Francis Group, 2015.
30. A. Kundagrami, **R. Kumar**, and M. Muthukumar, "Simulations and Theories of Single Polyelectrolyte Chains," in "Modeling and Simulation in Polymers," edited by P.D. Gujrati and A.I. Leonov, WILEY-VCH Verlag, Weinheim, Germany, 2010.

Conference Presentations : Invited

1. **R. Kumar**, "Polymerized ionic liquid films in strong electric fields: ion transport and nanopatterning," *TechConnect World Innovation Conference*, Washington, DC, June 2015 (talk).
2. **R. Kumar**, B.G. Sumpter, and M. Muthukumar, "Effects of dipolar interactions in polymeric media," *Energy Materials Nanotechnology (EMN) Meeting on Polymer*, Orlando, FL, Jan 2015 (talk).
3. **R. Kumar**, J. Carrillo, M. Goswami, and B.G. Sumpter, "Insights obtained from coarse-grained modeling of P3HT:PCBM active layers," *Energy Materials Nanotechnology (EMN) Summer Meeting*, Cancun, Mexico, June 2014 (talk).
4. **R. Kumar**, J. Carrillo, M. Goswami, and B.G. Sumpter, "Structure and dynamics of polymeric materials in complex solutions and thin films," *Physical Sciences Directorate (PSD) Advisory Committee Meeting*, Oak Ridge, TN, May 2014 (poster).
5. **R. Kumar**, B.G. Sumpter and S.M. Kilbey, "Local dielectric function in inhomogeneous polymeric media," *American Chemical Society Meeting*, Indianapolis, IN, September 2013 (talk).
6. **R. Kumar**, "Polymers near interfaces: field theory and neutron reflectivity experiments," *SNS-HIFR-CNMS User Workshop*, Oak Ridge National Laboratory, Oak Ridge, TN, August 2013 (talk).
7. S.W. Sides and **R. Kumar**, "Simulation of polymers in complex formulations: progress on developing numerical self-consistent field theory (SCFT)," *Proctor & Gamble/ORNL/TechX Corp. Reconnect*, Oak Ridge National Laboratory, Oak Ridge, TN, May 2012 (talk).
8. **R. Kumar**, "Theory and simulations of neutral and charged polymers," *Physics Department, University of Tennessee*, Knoxville, TN, April 2012 (talk).
9. **R. Kumar** and B.G. Sumpter, "Quantitative analysis of chain packing in polymer melts using large scale molecular dynamics simulations," *Scientific Discovery through Advanced Computing (SciDAC) Conference*, Denver, CO, July 2011 (poster).
10. **R. Kumar**, "Local dielectric function and its effects on planar polyelectrolyte brushes: field theoretical study," *Proctor & Gamble /ORNL /TechX Corp. Reconnect*, Oak Ridge National Laboratory, Oak Ridge, TN, June 2011 (talk).

11. **R. Kumar**, "Theory and simulations of neutral and charged polymers," *Department of Chemistry, University of Tennessee*, Knoxville, TN, March 2011 (talk).
12. **R. Kumar** and B.G. Sumpter, "Insights obtained from coarse-grained modeling of charged polymers," *66th Southwest and 62nd Southeastern Regional Meeting of the American Chemical Society*, New Orleans, LA, December 2010 (talk).
13. **R. Kumar**, "Modeling charged polymers using field-theoretic methods," *Center for Functional Nanomaterials, Brookhaven National Lab*, NY, March 2010 (talk).

Other Presentations

14. J. P. Mahalik, **R. Kumar**, and B.G. Sumpter, "Planar dipolar polymerr brush: field theoretical investigations," *American Physical Society Meeting*, San Antonio, TX, March 2015 (talk).
15. **R. Kumar**, V. Bocharova, E. Strelcov, V. Strehmel, J. R. Sangoro, A. P. Sokolov, S. V. Kalinin, and B. G. Sumpter, "Ion transport and softening in a polymerized ionic liquid," *American Physical Society Meeting*, San Antonio, TX, March 2015 (talk).
16. S. W. Sides, **R. Kumar**, L. Hall, J. Brown, "Self-consistent field theory simulations of block copolymer systems: Recent results using the PolySwift++ framework," San Francisco, CA, August 2014 (talk).
17. J. Carrillo , **R. Kumar**, M. Goswami , S. M. Kilbey II , B. G. Sumpter, and W. M. Brown, "Petascale molecular dynamics simulations of thermal annealing of P3HT:PCBM active layers in bulk heterojunctions", *American Physical Society*, Denver, CO, March 2014 (talk).
18. **R. Kumar**, M. Muthukumar, and B. G. Sumpter, "Effects of dipolar interactions on thermodynamic stabilities of polymer blends and diblock copolymer melts", *American Physical Society*, Denver, CO, March 2014 (talk).
19. J.Y. Carrillo, **R. Kumar**, M. Goswami, B.G. Sumpter and W.M. Brown, "Coarse-grained molecular dynamics simulations of thermal annealing of P3HT:PCBM bulk heterojunctions for organic photovoltaic applications," *American Institute of Chemical Engineers Annual Meeting*, San Francisco, CA, November 2013 (talk).
20. **R. Kumar**, B.G. Sumpter and S.M. Kilbey, "Charge regulation and local dielectric function in planar polyelectrolyte brushes," *American Physical Society*, Baltimore, MD, March 2013 (talk).
21. S.W. Sides, **R. Kumar**, B. Jamroz, R. Crockett and A. Pletzer, "Using adaptive-mesh refinement in SCFT simulations of surfactant adsorption," *American Physical Society*, Baltimore, MD, March 2013 (talk).
22. A.P. Sokolov, J.W. Mays, T. Zawodzinski, A. Kisliuk, K. Hong and **R. Kumar**, "Fundamentals of ionic conductivity in polymeric materials for energy storage applications," *Laboratory Directed Research and Development (LDRD) renewal, Oak Ridge National Laboratory*, Oak Ridge, TN, June 2011 (talk).
23. **R. Kumar**, S.W. Sides and B.G. Sumpter, "Local dielectric constant and its effects on the microphase separation in charged-neutral diblock copolymer melts," *American Physical Society*, Dallas, TX, March 2011 (talk).
24. **R. Kumar**, B.G. Sumpter and S.M. Kilbey, "Charge regulation and local dielectric function in planar polyelectrolyte brushes," *Center for Nanophase Materials Sciences User Meeting, Oak Ridge National Laboratory*, Oak Ridge, TN, September 2012 (poster).

25. A.P. Sokolov, J.W. Mays, T. Zawodzinski, A. Kisliuk, K. Hong and **R. Kumar**, "Fundamentals of ionic conductivity in polymeric materials for energy storage applications," *Laboratory Directed Research and Development (LDRD) renewal*, Oak Ridge National Laboratory, Oak Ridge, TN, June 2011 (talk).
26. **R. Kumar**, S.W. Sides and B.G. Sumpter, "Local dielectric constant and its effects on the microphase separation in charged-neutral diblock copolymer melts," *American Physical Society*, Dallas, TX, March 2011 (talk).
27. A. Sokolov, J.W. Mays, T. Zawodzinski, A. Kisliuk, K. Hong and **R. Kumar**, "Fundamentals of ionic conductivity in polymeric materials for energy storage applications," *Laboratory Directed Research and Development (LDRD) proposal*, Oak Ridge National Laboratory, Oak Ridge, TN, August 2010 (talk).
28. **R. Kumar** and G.H. Fredrickson, "Coacervation in symmetric mixtures of oppositely charged rodlike polyelectrolytes," *American Physical Society*, Portland, OR, March 2010 (talk).
29. **R. Kumar** and M. Muthukumar, "Origin of translocation barriers for polyelectrolyte chains," *American Physical Society*, Portland, OR, March 2010 (poster).
30. **R. Kumar**, D. Audus and G.H. Fredrickson "Theoretical investigations of complex coacervates for biosensor technology," *Institute for Collaborative Biotechnologies Army-Industry Collaboration Conference*, Santa Barbara, CA, March 2010 (poster).
31. **R. Kumar** and G.H. Fredrickson, "Coacervation in symmetric mixtures of oppositely charged rodlike polyelectrolytes," *Complex Fluids Design Consortium*, Santa Barbara, CA, February 2010 (talk).
32. **R. Kumar** and G.H. Fredrickson, "Theory of polyelectrolytic solutions," *American Physical Society*, Pittsburgh, PA, March 2009 (talk).
33. D. Audus, **R. Kumar** and G.H. Fredrickson, "Theoretical investigations of polyelectrolyte complexes for biosensors," *Institute for Collaborative Biotechnologies Army-Industry Collaboration Conference*, Santa Barbara, CA, March 2009 (poster).
34. **R. Kumar** and G.H. Fredrickson, "Conformational characteristics of a single polyelectrolytic chain: effect of salt," *Complex Fluids Design Consortium*, Santa Barbara, CA, Feb. 2009 (talk).
35. **R. Kumar** and M. Muthukumar, "Confinement free energy of flexible polyelectrolytes in spherical cavities," *American Physical Society*, New Orleans, LA, March 2008 (talk).
36. **R. Kumar** and M. Muthukumar, "Confinement effects on flexible polyelectrolytic systems," *Modeling and Computation in Physics, Mathematics and Biology, University of Massachusetts, Amherst /University of Heidelberg Workshop*, Amherst, MA, May 2007 (poster).
37. **R. Kumar** and M. Muthukumar, "Morphology diagrams for polyelectrolytic diblock copolymers," *American Physical Society*, Baltimore, MD, March 2006 (talk).
38. **R. Kumar** and M. Muthukumar, "Morphology diagrams for polyelectrolytic diblock copolymers," *6th National Graduate Research Conference, University of Massachusetts, Amherst, MA*, June 2005 (talk).