Song Zhang

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Professional Experience & Education

Ph.D. Polymer Science & Engineering, The University of Southern Mississippi 2016 - 2021

Topic: Structure-thermal/mechanical property-morphology-performance relationship of organic semiconductors for flexible electronics application
Advisor: Professor Xiaodan Gu

- Established film-on-water tensile tests on ultrathin polymeric films (< 100 nm)
- Decoupled the backbone and side-chain effect on the thermal, mechanical, and morphological properties of semiconducting polymers
- Resolved chain alignment mechanism for semiconducting polymer thin films upon tensile deformation
- Performed the first quantitative fracture energy test on ultra-thin polymeric films

M.S. Material Science & Engineering, Worcester Polytechnic Institute 2014 - 2016

Topic: Bioinspired Multilayered Ceramic/Metal Composites
Advisor: Professor Nima Rahbar

B.S. Polymer Science & Engineering, Nanjing University of Posts and Telecommunications, China 2010 - 2014

Awards and Honors

Frank J. Padden Jr. Award finalist, American Physical Society, USA 2021

Graduate student research award, University of Southern Mississippi, USA 2021

Graduate student Hall of Fame, University of Southern Mississippi, USA 2021

Graduate Competitive Travel Award, University of Southern Mississippi, USA 2020

Graduate Competitive Travel Award, University of Southern Mississippi, USA 2019

Charles E. Hoyle Memorial Polymer Science Scholarship, University of Southern Mississippi, USA 2019

Charles E. Hoyle Memorial Polymer Science Scholarship, University of Southern Mississippi, USA 2018

Selected Publications

Google Scholar: https://scholar.google.com/citations?user=osQouCwAAAAJ

1. **Zhang, S.**; Gu, X. Thin-film tensile test on the water surface. (Review paper) *Under Review*
2. **Zhang, S.**; Koizumi, M.; Galuska, L.; Qian, Z.; Cao, Z.; Ehlenberg, D.; Jin, L.; Gu, X. Direct probing the fracture behavior of ultra-thin polymeric films. *Under Review*
3. **Zhang, S.**; Alesadi, A.; Selivanova, M.; Galuska, L.; Luo, S.; Freychet, G.; Ocheje, M.U.; Qian, Z.; Ma, G.; Dhakal, S.; Ahmed, Z.; Zhou, D.; Rondeau-Gagne, S.; Xia, W.; Gu, X. Molecular origin of strain-induced chain alignment in PDPP-based semiconducting polymers. *Adv. Funct. Mater.* 2021, 2100161
4. **Zhang, S.**; Alesadi, A.; Selivanova, M.; Cao, Z.; Qian, Z.; Luo, S.; Galuska, L.; Teh, C.; Ocheje, M.U.; Mason, G.T.; St. Onge, P.B.J.; Zhou, D.; Rondeau-Gagne, S.; Xia, W.; Gu, X. Toward the Prediction and Control of Glass Transition Temperature for Donor-Acceptor Polymers. *Adv. Funct. Mater.* 2020, 2002221.
5. **Zhang, S.**; Cheng, Y.-H.; Galuska, L.; Roy, A.; Lorenz, M.; Chen, B.; Luo, S.; Li, Y.-T.; Hung, C.-C.; Qian, Z.; St. Onge, P.B.J.; Mason, G.T.; Cowen, L.; Zhou, D.; Nazarenko. S.I.; Storey, R.F.; Schroeder, B.C.; Rondeau-Gagne, S.; Chiu, Y.-C.; Gu, X. Tacky Elastomers to Enable Tear-Resistant and Autonomous Self-Healing Semiconductor Composites. *Adv. Funct. Mater.* 2020, 2000663.
6. **Zhang, S.**; Ocheje, M. U.; Huang, L.; Galuska, L.; Cao, Z.; Luo, S.; Cheng, Y.-H.; Ehlenberg, D.; Goodman, R. B.; Zhou, D.; Liu, Y.; Chiu, Y-C.; Azoulay, J.D.; Rondeau-Gagne, S.; Gu, X. The Critical Role of Electron-Donating Thiophene Groups on the Mechanical and Thermal Properties of Donor-Acceptor Semiconducting Polymers. *Adv. Electron. Mater.* 2019, 5 (5), 1800899.
7. **Zhang, S.**; Ocheje, M. U.; Luo, S.; Ehlenberg, D.; Appleby, B.; Weller, D.; Zhou, D.; Rondeau-Gagne, S.; Gu, X. Probing the Viscoelastic Property of Pseudo Free-Standing Conjugated Polymeric Thin Films. *Macromol. Rapid Commun.* 2018, 39 (14), 1800092.
8. Gu, X.; Ehlenberg, D.F; **Zhang, S.**. Methodology and Instrumentation for Thin Film Mechanical Analysis. U.S. Patent Application 16/401,009.2019.
9. Selivanova, M.; **Zhang, S.**; Billet, B.; Malik, A.; Prine, N.; Landry, E.; Gu, X.; Xiang, P.; Rondeau-Gagne, S. Branched Polyethylene as a Plasticizing Additive to Modulate the Mechanical Properties of π-Conjugated Polymers. *Macromolecules.* 2019, 52(20), 7870-7877
10. Zheng, Y.; Ashizawa, M.; **Zhang, S.**; Kang, J.; Nikzad, S.; Yu, Z.; Ochiai, Y.; Wu, H.C.; Tran, H.; Mun, J.; Zheng, Y.Q.; Tok, J.B.H.; Gu, X.; Bao, Z. Tuning mechanical properties of polymer semiconductor by modulating hydrogen bonding interactions. *Chem. Mater.* 2020, 32(13), 5700-5714
11. Wang, G.-J. N.; Zheng, Y.; **Zhang, S.**; Kang, J.; Wu, H.-C.; Gasperini, A.; Zhang, H.; Gu, X.; Bao, Z. Tuning the Cross-Linker Crystallinity of a Stretchable Polymer Semiconductor. *Chem. Mater.* 2018, 31(17), 6465-6475.
12. Pang, S.; Zhou, X.; **Zhang, S.**; Tang, H.; Dhakal, S.; Gu, X.; Duan, C.; Huang, F.; Cao, Y. Nonfused Nonfullerene Acceptors with an A-D-A'-D-A Framework and a Benzothiadiazole Core for High-Performance Organic Solar Cells. *ACS Appl. Mater. Interfaces.* 2020. 12(14), 16531-16540.
13. Li, B.; Zhang, Q.; **Zhang, S.**; Ahmad, Z.; Chidanguro, T.; Davis, A.H.; Simon, Y.C.; Gu, X.; Zheng, W.; Pradhan, N.; Dai, Q. Spontaneously Supersaturated Nucleation Strategy for High Reproducible and Efficient Perovskite Solar Cells. *Chem. Eng.* 2020, 126998.

14. Luo, S.; Li, N.; **Zhang, S.**; Zhang, C.; Qu, T.; Ocheje, M. U.; Xue, J.; Gu, X.; Simon, Y.C.; Hu, W.; Wang, S.; Teng, C; Zhou, D.; Jie, X. Observation of Stepwise Ultrafast Crystallization Kinetics of Donor-Acceptor Conjugated Polymers and Correlation with Field Effect Mobility. *Chem. Mater.* 2021, Accepted.

15. Li, Q.Y.; Yao, Z.F.; Lu, Y.; **Zhang, S.**; Ahmad, Z.; Wang, J.Y.; Gu, X; Pei, J. Achieving High Alignment of Conjugated Polymers by Controlled Dip-Coating. *Adv. Electron. Mater.* 2020, 2000080.

16. Wang, K.; Huang, L.; Eedugurala, N.; **Zhang, S.**; Sabuj, M.A.; Rai, N.; Gu, X.; Azoulay, J.D.; Ng, T.N. Wide Potential Window Supercapacitors Using Open-Shell Donor-Acceptor Conjugated Polymers with Stable N-Doped States. *Adv. Energy. Mater.* 2019, 9(47), 1902806.

17. Mishra, S.; Badani Prado, R.M.; **Zhang, S.**; Lacy, T.E.; Gu, X; Kundu, S. Mechanical Properties and Failure Behavior of Physically Assembled Triblock Copolymer Gels with Varying Midblock Length. *J. Polym. Sci. Part B Polym. Phys* 2019, 57 (15), 1014-1026.

18. Ocheje, M.U.; Selivanova, M.; **Zhang, S.**; Van Nguyen, T.H.; Charron, B.P.; Chuang, C.-H.; Cheng, Y.-H.; Billet, B.; Noori, S.; Chiu, Y.-C.; et al. Influence of Amide-Containing Side Chains on the Mechanical Properties of Diketopyrrolopyrrole-Based Polymers. *Polym. Chem.* 2018, 9 (46), 5531-5542.

19. Huang, L.; Eedugurala, N.; Benasco, A.; **Zhang, S.**; Mayer, K.S.; Adams, D.J.; Fowler, B.; Lockart, M.M.; Saghayezhian, M.; Tahir, H; King, E.R.; Morgan, S.; Bowman, M.K.; Gu, X.; Azoulay, J.D. Open-Shell Donor-Acceptor Conjugated Polymers with High Electrical Conductivity. *Adv. Funct. Mater.* 2020. 1909805.

20. Xiong, M.; Yan, Xin.; Li, J-T; **Zhang, S.**; Cao, Z.; Prine, N.; Lu, Y.; Wang, J-Y; Gu, X.;Let, T. Efficient n-Doping of Polymeric Semiconductors through Controlling the Dynamics of SolutionâĂŘState Polymer Aggregates. *Angew. Chemie Int. Ed.* 2021

21. Galuska, L.A.; McNutt, W.W.; Qian, Z.; **Zhang, S.**; Weller, D.W.; Dhakal, S.; King, E.R.; Morgan, S.E.; Azoulay, J.D.; Mei, J; Gu, X. Impact of Backbone Rigidity on the Thermomechanical Properties of Semiconducting Polymers with Conjugation Break Spacers. Macromolecules. 2020. 53(14), 6032-6042.

22. Yan, X.; Xiong, M.; Li, J.; **Zhang, S.**; Ahmad, Z.; Lu, Y.; Wang, Z.; Yao, Z.; Wang, J.; Gu, X; Lei, T. Pyrazine-Flanked Diketopyrrolopyrrole (DPP): A New Polymer Building Block for High-Performance n-Type Organic Thermoelectrics. *J. Am. Chem. Soc.* 2019, 141 (51), 20215-2021.

23. Pang, S.; Zhang, R.; Duan, C.; **Zhang, S.**; Liu, X.; Gu, X.; Huang, F.; Cao, Y. Alkyl Chain Length Effects of Polymer Donors on the Morphology and Device Performance of Polymer Solar Cells with Different Acceptors. *Adv. Energy. Mater.* 2019, 9 (30), 1901740.

24. Luo, S.; Wang, T.; Ocheje, M.U.; **Zhang, S.**; Xu, J.; Qian, Z.; Gu, X.; Xue, G.; Rondeau-Gagne, S.; Jiang, J.; Hu, W.; Zhuravlev, E.; Zhou, D. Multiamorphous Phases in Diketopyrrolopyrrole-Based Conjugated Polymers: From Bulk to Ultrathin Films. *Macromolecules.* 2020. 53(11), 4480-4489

25. Qian, Z.; Cao, Z.; Galuska, L.; **Zhang, S.**; Xu, J.; Gu, X. Glass Transition Phenomenon for Conjugated Polymers. *Macromol. Chem. Phys.* 2019, 220 (11), 1900062.

26. Shafranek, R. T.; Leger, J. D.; **Zhang, S.**; Khalil, M.; Gu, X.; Nelson, A. Sticky Ends in a Self-Assembling ABA Triblock Copolymer: The Role of Ureas in Stimuli-Responsive Hydrogels. *Mol. Syst. Des. Eng.* 2019, 4 (1), 91-102.

27. McFarland, F. M.; Liu, X.; **Zhang, S.**; Tang, K.; Kreis, N. K.; Gu, X.; Guo, S. Electric Field Induced Assembly of Macroscopic Fibers of Poly(3-Hexylthiophene). *Polymer.* 2018, 151, 56-64.

28. Cao, Z.; Galuska, L.; Qian, Z.; **Zhang, S.**; Huang, L.; Prine, N.; Li, T.; He, Y.; Hong, K.; Gu, X. The effect of side-chain branch position on the thermal properties of poly (3-alkylthiophenes). *Polym. Chem.* 2020, 59, 277-284.

29. Jia, H.; Huang, Z.; Li, P.; **Zhang, S.**; Wang, Y.; Wang, J-Y; Gu, X.; Lei, T. Engineering Donor-Acceptor Conjugated Polymers for High-Performance and Fast-Response Organic Electrochemical Transistors. *J. Mater. Chem. C.* 2021. 9(14), 4927-4934

30. Qian, Z.; Luo, S.; Qu, T.; Galuska, L.A.; **Zhang, S.**; Cao, Z.; Dhakal, S.; He, Y.; Hong, K.; Zhou, D; Gu, X. Influence of side-chain isomerization on the isothermal crystallization kinetics of poly (3-alkylthiophenes). *J. Mater. Res.* 2020, 1-12.

31. Yao, Z.; Zheng, Y.; Li, Q.; Lei, T.; **Zhang, S.**; Zou, L.; Liu, H.; Dou, J.; Lu, Y.; Wang, J.; Gu, X.; Pei, J. Wafer-Scale Fabrication of High-Performance n-Type Polymer Monolayer Transistors Using a Multi-Level Self-Assembly Strategy. *Adv. Mater.* 2019, 31 (7), 1806747.

32. Liu, X.; Deng, W.; Wang, J.; Zhang, R.; **Zhang, S.**; Galuska, L.; Pang, S.; Gu, X.; Qiao, X.; Ma, D; Wu, H.; Duan, C.; Huang, F.; Cao, Y. Energy level modulation of donor-acceptor alternating random conjugated copolymers for achieving high-performance polymer solar cells. *J. Mater. Chem. C.* 2019, 7(48), 15335-15343.

33. Wu, Z.; Zhai, Y.; Yao, W.; Eedugurala, N.; **Zhang, S.**; Huang, L.; Gu, X.; Azoulay, J. D.; Ng, T. N. The Role of Dielectric Screening in Organic Shortwave Infrared Photodiodes for Spectroscopic Image Sensing. *Adv. Funct. Mater.* 2018, 28 (50), 1805738.

34. Galuska, L.; Muckley, E.; Cao, Z.; Ehlenberg, D.; Qian, Z.; **Zhang, S.**; Rondeau-Gagne, S.; Phan, M.; Ankner, J.; Ivanov, I.; Gu, X. SMART transfer method to directly compare the mechanical response of water-supported and free-standing ultrathin polymeric films. *Nature Comms* 2021, 12, 1-11.

35. Lin, B.; Zhang, L.; Zhao, H.; Xu, X.; Zhou, K.; **Zhang, S.**; Gou, L. Molecular packing control enables excellent performance and mechanical property of blade-cast all-polymer solar cells. *Nano Energy* 2019, 59, 277-284.

36. Zheng, Y.; Wang, G.-J.N.; Kang, J.; Nikolka, M.; Wu, H.-C.; Tran, L.; **Zhang, S.**; Yan, H.; Chen, H.; Yuen, Y. P.; Mun, J.; Dauskardt, R.; McCulloch, I.; Tok, J.; Gu, X.; Bao, Z. An Intrinsically Stretchable High-Performance Polymer Semiconductor with Low Crystallinity. *Adv. Funct. Mater.* 2019, 1905340.

37. Qian, Z.; Galuska, L.; McNutt, W. W.; Ocheje. M. U.; He, Y.; Cao, Z.; **Zhang, S.**; Xu, J.; Hong, K.; Goodman, R. B.; He, Y.; Rondeau-Gagne, S.; Mei, J.; Gu, X. Challenge and solution of characterizing glass transition temperature for conjugated polymers by differential scanning calorimetry. *J Polym Sci B Polym Phys.* 2019, 57 (23), 1635-1644.

Conference Presentations

Talk at APS National Meeting & Exposition , Virtual, March 15-19; 2021 (Padden Award Session)
Song Zhang, Amirhadi Alesadi, Mariia Selivanova, Wenjie Xia, Simon Rondeau-Gagne, Xiaodan Gu; Molecular origin of strain-induced chain alignment in PDPP-based semiconducting polymers

Talk at CNMS User Meeting, Virtual, August 10-12; 2020
Song Zhang, Yu-Hsuan Cheng, Yu-Cheng Chiu, Xiaodan Gu; Tacky Elastomers to Enable Tear-Resistant and Autonomous Self-Healing Semiconductor Composites.

Talk at MRS Spring Meeting & Exhibit (Cancelled), Phoenix, AZ, April 13-17; 2020
Song Zhang, Amirhadi Alesadi, Wenjie Xia, Xiaodan Gu; Towards the Prediction and Design of Low-Glass Transition Donor-Acceptor Semiconducting Polymers.

Talk at APS National Meeting & Exposition (Cancelled), Boston, MA, March 2-6; 2020
Song Zhang, Masato Koizumi, Lihua Jin, Xiaodan Gu; Direct probing of the fracture behavior for pseudo-free-standing polymeric ultra-thin films.

Talk at MRS Spring Meeting & Exhibit, Phoenix, AZ, April 22-26; 2019
Song Zhang, Michael U. Ocheje, Simon Rondeau-Gagne, Xiaodan Gu; Controlling the Mechanical and Thermal Properties of Donor-Acceptor Semiconducting Polymers.

Talk at APS National Meeting & Exposition, Boston, MA, March 4-8; 2019
Song Zhang, Michael U. Ocheje, Simon Rondeau-Gagne, Xiaodan Gu; Critical Role of Electron-Donating Thiophene Group on the Mechanical and Thermal Properties of Donor-Acceptor Semiconducting Polymers.

Talk at APS National Meeting & Exposition, Los Angeles, CA, March 5-9; 2018
Song Zhang, Dakota Ehlenberg, Simon Rondeau-Gagne, Xiaodan Gu; Structure-mechanical properties of pseudo free-standing conjugated polymeric thin films.

Talk at 82nd annual meeting of the Mississippi Academy of Sciences, Hattiesburg, MS, February 22-23; 2018
Song Zhang, Dakota Ehlenberg, Xiaodan Gu; Mechanical test of viscoelastic conjugated polymer thin film for flexible electronics.

Professional Affilications

Member of the American Physical Society

Member of the Materials Research Society

Member of the American Institute of Chemical Engineers

Supervised Undergraduate Students

Juan Correaruiz	2017- present
Zac Ahmad	2019- present
Sujata Dhakal	2017- 2020
Dakota F. Ehlenberg	2017- 2019
Catherine Teh	2019
Ben Appleby	2017

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