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EDUCATION

Brown University

Ph.D., Mechanical Engineering 2008–2014

Peking University

M.S., Mechanical Engineering 2005–2008

B.Eng., Mechanical Engineering 2001–2005

PROFESSIONAL EXPERIENCE

Peking University, Associate Professor, College of Engineering 02/2023–present

Peking University, Assistant Professor, College of Engineering 11/2016–02/2023

Dartmouth College, Postdoctoral Associate 07/2016–11/2016

Brown University, Postdoctoral Associate 2014–06/2016

RESEARCH INTERESTS

Solid mechanics, Nanomechanics, Cell mechanics

- Mechanics of cell-nanomaterials interaction
- Mechanics of nanostructured metallic materials

HONORS AND AWARDS

NG Teng Fong/Sino Scholarship for Outstanding Youth Faculty, Peking University, 2021

Excellent Young Researcher Award, NSFC, 2021–2023

TEACHING

For undergraduates

- Mechanics of Materials (Springs '18–'23)

For graduates

- Introduction to Biophysics (Fall '17),
- Applied Mathematics for Biomedicine (Falls '18–'23)

PROFESSIONAL ACTIVITIES

Reviewer for *ACS Applied Materials & Interfaces*, *ACS Nano*, *Advanced Materials*, *Advanced Functional Materials*, *Advanced Science*, *Biomaterials*, *Biophysical Journal*, *Extreme Mechanics Letters*, *International Journal of Mechanical Sciences*, *International Journal of Solids and Structures*, *Journal of Applied Mechanics*, *Journal of the Mechanics and Physics of Solids*, *Nanoscale*, *Physical Review E*, *Physical Review Letters*, *Science Advances*, *Small*, *Soft Matter*, etc.

Journal Publications

1. M. Wang and **X. Yi**, Area difference between monolayers facilitates budding of lipid droplets from vesicles. *Soft Matter* 19(39), 7494–7501 (2023).
2. H. L. Liu, M. Yi, J. X. Wang, and **X. Yi**, Numerical simulations of powder spreading process in selective laser melting and powder layer characterization. *Chinese Journal of Theoretical and Applied Mechanics* 55(9), 1921–1938 (2023).
3. J. L. Li, Z. H. Dong, **X. Yi**, D. Wu, and R. S. Chen, Twin evolution in cast Mg-Gd-Y alloys and its dependence on aging heat treatment. *Journal of Magnesium and Alloys* 11(7), 2285–2298 (2023).
4. C. Shi, G. J. Zou, Z. M. Wu, M. Wang, X. Y. Zhang, H. J. Gao, and **X. Yi**, Morphological transformations of vesicles with confined flexible filaments. *Proceedings of the National Academy of Sciences of the U. S. A.* 120(18), e2300380120 (2023).
5. Q. F. Han, J. L. Li, and **X. Yi**, Overcoming strength–ductility trade-off of nanocrystalline metallic materials by engineering grain boundary, texture, and gradient microstructure. *Journal of the Mechanics and Physics of Solids* 173, 105200 (2023).
6. S. Y. Peng, Y. H. Wang, **X. Yi**, Y. F. Zhang, Y. Liu, Y. Y. Cheng, H. L. Duan, Q. Huang, and J. M. Xue, Ion irradiation induced softening in Cr₂AlC MAX phase. *Journal of Alloys and Compounds* 939, 168660 (2023).
7. D. Zou, Z. M. Wu, **X. Yi**, Y. Hui, G. Z. Yang, Y. Liu, Tengjisi, H. F. Wang, A. Brooks, H. L. Wang, X. Liu, Z. P. Xu, M. S. Roberts, H. J. Gao, and C.-X. Zhao, Nanoparticle elasticity regulates the formation of cell membrane-coated nanoparticles and their nano-bio interactions. *Proceedings of the National Academy of Sciences of the U. S. A.* 120(1), e2214757120 (2023).
8. Z. H. Liang, M. Chen, **X. Yi**, and W. P. Zhu, Membrane-tension-dominated growth mechanism and size modulation of giant unilamellar vesicles in electroformation. *Journal of the Mechanics and Physics of Solids* 170, 105120 (2023).
9. X. Y. Zhang, C. Shi, Z. M. Wu, and **X. Yi**, Indentation of pore-spanning lipid membranes: Spring-stiffening or -softening responses and apparent stiffness prediction. *Extreme Mechanics Letters* 57, 101917 (2022).
10. H. L. Liu, J. F. Pang, J. X. Wang, and **X. Yi**, New heat source model for accurate estimation of laser energy absorption near free surface in selective laser melting. *Extreme Mechanics Letters* 56, 101894 (2022).
11. H. Y. Wan, Z. Z. Liu, Q. Q. Han, and **X. Yi**, Laser additive manufacturing of cracking-resistant superalloys. *Aeronautical Science & Technology* 33(9), 26–42 (2022).
12. F. Y. Lu, H. Y. Wan, X. Ren, L. M. Huang, H. L. Liu, and **X. Yi**, Mechanical and microstructural characterization of additive manufactured Inconel 718 alloy by selective laser melting and laser metal deposition. *Journal of Iron and Steel Research International* 29(8), 1322–1333 (2022).
13. Q. F. Han and **X. Yi**, High pressure-induced elimination of grain size softening in nanocrystalline metals: Grain boundary strengthening overwhelming reduction of intragranular dislocation storage ability. *International Journal of Plasticity* 153, 103261 (2022).
14. Z. H. Dong, X. Y. Zhang, S. Y. Peng, F. Jin, Q. Wan, J. M. Xue, and **X. Yi**, Mechanical

- properties of GaN single crystals upon C ion irradiation: Nanoindentation analysis. *Materials* 15(3), 1210 (2022).
15. X. Ren, H. Peng, J. L. Li, H. L. Liu, L. M. Huang, and X. Yi, Selective electron beam melting (SEBM) of pure tungsten: Metallurgical defects, microstructure, texture and mechanical properties. *Materials* 15(3), 1172 (2022).
 16. S. Y. Peng, K. Jin, X. Yi, Z. H. Dong, X. Guo, Y. Liu, Y. Y. Cheng, N. N. Jia, H. L. Duan, and J. M. Xue, Mechanical behavior of the HfNbZrTi high entropy alloy after ion irradiation based on micro-pillar compression tests. *Journal of Alloys and Compounds* 892, 162043 (2021).
 17. M. Yi, K. Chang, C. G. Liang, L. C. Zhou, Y. Y. W. Yang, X. Yi, and B.-X. Xu, Computational study of evolution and fatigue dispersity of microstructures by additive manufacturing. *Chinese Journal of Theoretical and Applied Mechanics* 53(12), 3263–3273 (2021).
 18. M. Wang and X. Yi, Bulging-to-budding transition of lipid droplets confined within vesicle membranes. *Langmuir* 37(44), 12867–12873 (2021).
 19. Z. M. Wu and X. Yi, Membrane-mediated interaction of intercellular cylindrical nanoparticles. *Physical Review E* 104(3), 034403 (2021).
 20. Q. F. Han and X. Yi, A unified mechanistic model for Hall–Petch and inverse Hall–Petch relations of nanocrystalline metals based on intragranular dislocation storage. *Journal of the Mechanics and Physics of Solids* 154, 104530 (2021).
 21. Z. M. Wu and X. Yi, Mechanics of cell interaction with intercellular nanoparticles: Shape-dependent competition between two-membrane trapping and single-membrane wrapping. *Extreme Mechanics Letters* 46, 101296 (2021).
 22. X. Y. Li, H. L. Duan, P. Y. Lv, and X. Yi, Soft actuators based on liquid–vapor phase change composites. *Soft Robotics* 8(3), 251–261 (2021).
 23. M. Wang and X. Yi, Bulging and budding of lipid droplets from symmetric and asymmetric membranes: competition between membrane elastic energy and interfacial energy. *Soft Matter* 17(21), 5319–5328 (2021).
 24. S. Wang, X. Y. Li, X. Yi, and H. L. Duan, Morphological changes of nanofiber cross-sections due to surface tension. *Extreme Mechanics Letters* 44, 101211 (2021).
 25. X. Ren, H. L. Liu, F. Y. Lu, L. M. Huang, and X. Yi, Effects of processing parameters on the densification, microstructures and mechanical properties of pure tungsten fabricated by optimized selective laser melting: From single and multiple scan tracks to bulk parts. *International Journal of Refractory Metals and Hard Materials* 96, 105490 (2021).
 26. X. Y. Li, S. Wang, L. Lu, P. Y. Lv, X. Yi, and H. L. Duan, Design, fabrication and mechanical properties of soft composites with liquid inclusions. *Acta Materialia Compositae Sinica* 38(1), 1–15 (2021). (in Chinese)
 27. W. B. Liu, Y. Liu, H. N. Sui, L. R. Chen, L. Yu, X. Yi, and H. L. Duan, Dislocation-grain boundary interaction in metallic materials: Competition between dislocation transmission and dislocation source activation. *Journal of the Mechanics and Physics of Solids* 145, 104158 (2020).
 28. W. B. Liu, Y. Liu, Y. Y. Cheng, L. R. Chen, L. Yu, X. Yi, and H. L. Duan, Unified model for size-dependent to size-independent transition in yield strength of crystalline metallic

- materials. *Physical Review Letters* 124(23), 235501 (2020).
29. Y. Hui, **X. Yi**, D. Wibowo, G. Z. Yang, A. P. J. Middelberg, H. J. Gao, and C.-X. Zhao, Nanoparticle elasticity regulates phagocytosis and cancer cell uptake. *Science Advances* 6(16), eaaz4316 (2020).
 30. Z. M. Wu and **X. Yi**, Structures and mechanical behaviors of soft nanotubes confining adhesive single or multiple elastic nanoparticles. *Journal of the Mechanics and Physics of Solids* 137, 103867 (2020).
 31. L. R. Chen, W. B. Liu, L. Yu, Y. Y. Cheng, K. Ren, H. N. Sui, **X. Yi**, and H. L. Duan, Probabilistic and constitutive models for ductile-to-brittle transition in steels: A competition between cleavage and ductile fracture. *Journal of the Mechanics and Physics of Solids* 135, 103809 (2020).
 32. X. Y. Tang, X. H. Shi, Y. Gan, and **X. Yi**, Nanomechanical characterization of pressurized elastic fluid nanovesicles using indentation analysis. *Extreme Mechanics Letters* 34, 100613 (2020).
 33. X. Y. Tang, J. X. Wang, and **X. Yi**, Force barrier for lipid sorting in the formation of membrane nanotubes. *Journal of Applied Mechanics* 86(12), 121002 (2019).
 34. Z. S. Yan, Z. M. Wu, S. X. Li, X. R. Zhang, **X. Yi**, and T. T. Yue, Curvature-mediated cooperative wrapping of multiple nanoparticles at the same and opposite membrane sides. *Nanoscale* 11(42), 19751–19762 (2019).
 35. Y. Y. Cheng, L. Yu, L. R. Chen, W. B. Liu, **X. Yi**, and H. L. Duan, Failure of fracture toughness criterion at small scales. *Physical Review Materials* 3(11), 113602 (2019).
 36. Z. Dai, M. R. Yu, **X. Yi**, Z. M. Wu, F. L. Tian, Y. Q. Miao, W. Y. Song, S. F. He, E. Ahmad, S. Y. Guo, C. L. Zhu, X. X. Zhang, Y. M. Li, X. H. Shi, R. Wang, and Y. Gan, Chain-length- and saturation-tuned mechanics of fluid nanovesicles direct tumor delivery. *ACS Nano* 13(7), 7676–7689 (2019).
 37. Y. Hui, **X. Yi**, F. Hou, D. Wibowo, F. Zhang, D. Y. Zhao, H. J. Gao, and C.-X. Zhao, Role of nanoparticle mechanical properties in cancer drug delivery. *ACS Nano* 13(7), 7410–7424 (2019).
 38. X. Y. Tang, J. X. Wang, and **X. Yi**, Finite indentation of pressurized elastic fluid nanovesicles by a rigid cylindrical indenter. *Acta Mechanica Solida Sinica* 32(5), 633–642 (2019).
 39. W. B. Liu, L. R. Chen, Y. Y. Cheng, L. Yu, **X. Yi**, H. J. Gao, and H. L. Duan, Model of nanoindentation size effect incorporating the role of elastic deformation. *Journal of the Mechanics and Physics of Solids* 126, 245–255 (2019).
 40. T. T. Yue, H. Y. Zhou, H. N. Sun, X. R. Zhang, D. P. Cao, S. X. Li, **X. Yi**, and B. Yan, Why are nanoparticles trapped at cell junctions when the cell density is high? *Nanoscale* 11(14), 6602–6609 (2019).
 41. Z. M. Wu, H. Y. Yuan, X. Y. Zhang, and **X. Yi**, Sidewall contact regulating the nanorod packing inside vesicles with relative volumes. *Soft Matter* 15(12), 2552–2559 (2019).
 42. M. R. Yu, W. Y. Song, F. L. Tian, Z. Dai, Q. L. Zhu, E. Ahmad, S. Y. Guo, C. L. Zhu, H. J. Zhong, Y. C. Yuan, T. Zhang, **X. Yi**, X. H. Shi, Y. Gan, and H. J. Gao, Temperature- and rigidity-mediated rapid transport of lipid nanovesicles in hydrogels. *Proceedings of the National Academy of Sciences of the U. S. A.* 116(12), 5362–5369 (2019).

43. S. X. Li, Z. S. Yan, Z. Luo, Y. Xu, F. Huang, X. R. Zhang, **X. Yi**, and T. T. Yue, Mechanics of the formation, interaction and evolution of membrane tubular structures. *Biophysical Journal* 116(5), 884–892 (2019).
44. X. Y. Li, J. M. Zhang, **X. Yi**, Z. Y. Huang, P. Y. Lv, and H. L. Duan, Multimaterial microfluidic 3D printing of textured composites with liquid inclusions. *Advanced Science* 6(3), 1800730 (2019).
45. Z. Q. Shen, H. L. Ye, **X. Yi**, and Y. Li, Membrane wrapping efficiency of elastic nanoparticles during endocytosis: Size and shape matter. *ACS Nano* 13(1), 215–228 (2019).
46. **X. Yi**, G. J. Zou, and H. J. Gao, Mechanics of cellular packing of nanorods with finite and non-uniform diameters. *Nanoscale* 10(29), 14090–14099 (2018).
47. G. J. Zou, **X. Yi**, W. P. Zhu, and H. J. Gao, Packing of flexible 2D materials in vesicles. *Journal of Physics D: Applied Physics* 51(22), 224001 (2018).
48. G. J. Zou, **X. Yi**, W. P. Zhu, and H. J. Gao, Packing of flexible nanofibers in vesicles. *Extreme Mechanics Letters* 19, 20–26 (2018).
49. F. L. Tian, T. T. Yue, W. Dong, **X. Yi**, and X. R. Zhang, Size-dependent formation of membrane nanotubes: continuum modeling and molecular dynamics simulations. *Physical Chemistry Chemical Physics* 20(5), 3474–3483 (2018).
50. B. Marzban, **X. Yi**, and H. Y. Yuan, A minimal mechanics model for mechanosensing of substrate rigidity gradient in durotaxis. *Biomechanics and Modeling in Mechanobiology* 17(3), 915–922 (2018).
51. **X. Yi** and H. J. Gao, Budding of an adhesive elastic particle out of a lipid vesicle. *ACS Biomaterials Science & Engineering* 3(11), 2954–2961 (2017).

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52. **X. Yi** and H. J. Gao, Kinetics of receptor-mediated endocytosis of elastic nanoparticles. *Nanoscale* 9(1), 454–463 (2017).
53. **X. Yi** and H. J. Gao, Incorporation of soft particles into lipid vesicles: Effects of particle size and elasticity. *Langmuir* 32(49), 13252–13260 (2016).
54. W. P. Zhu, A. von dem Bussche, **X. Yi**, Y. Qiu, Z. Y. Wang, P. Weston, R. H. Hurt, A. B. Kane, and H. J. Gao, Nanomechanical mechanism for lipid bilayer damage induced by carbon nanotubes confined in intracellular vesicles. *Proceedings of the National Academy of Sciences of the U. S. A.* 113(44), 12374–12379 (2016).
55. Z. Y. Wang, W. P. Zhu, Y. Qiu, **X. Yi**, A. von dem Bussche, A. Kane, H. J. Gao, K. Koski, and R. Hurt, Biological and environmental interactions of emerging two-dimensional nanomaterials. *Chemical Society Reviews* 45(6), 1750–1780 (2016).
56. **X. Yi** and H. J. Gao, Cell interaction with graphene microsheets: near-orthogonal cutting versus parallel attachment. *Nanoscale* 7(12), 5457–5467 (2015).
57. **X. Yi** and H. J. Gao, Cell membrane wrapping of a spherical thin elastic shell. *Soft Matter* 11(6), 1107–1115 (2015).
58. **X. Yi** and H. J. Gao, Phase diagrams and morphological evolution in wrapping of rod-shaped elastic nanoparticles by cell membrane: A two-dimensional study. *Physical Review E* 89(6), 062712 (2014).
59. **X. Yi**, X. H. Shi, and H. J. Gao, A universal law for cell uptake of one-dimensional

- nanomaterials. *Nano Letters* 14(2), 1049–1055 (2014).
60. X. Yi, X. H. Shi, and H. J. Gao, Cellular uptake of elastic nanoparticles. *Physical Review Letters* 107(9), 098101 (2011).
Erratum: Cellular uptake of elastic nanoparticles [Phys. Rev. Lett. 107, 098101 (2011)]. *Physical Review Letters* 121(19), 199902 (2018).
 61. B. X. Jing, J. Zhao, Y. Wang, X. Yi, and H. L. Duan, Water-swelling-induced morphological instability of a supported polymethyl methacrylate thin film. *Langmuir* 26(11), 7651–7655 (2010).
 62. H. L. Duan, Y. H. Xue, and X. Yi, Vibration of cantilevers with rough surfaces. *Acta Mechanica Solida Sinica* 22(6), 550–554 (2009).
 63. X. Yi and H. L. Duan, Surface stress induced by interactions of adsorbates and its effect on deformation and frequency of microcantilever sensors. *Journal of the Mechanics and Physics of Solids* 57(8), 1254–1266 (2009).
 64. X. Yi, H. L. Duan, Y. Chen, and J. X. Wang, Prediction of complex dielectric constants of polymer-clay nanocomposites. *Physics Letters A* 372(1), 68–71 (2007).
 65. X. Yi, H. L. Duan, B. L. Karihaloo, and J. X. Wang, Eshelby formalism for multi-shell nano-inhomogeneities. *Archives of Mechanics* 59(3), 259–281 (2007).
 66. H. L. Duan, X. Yi, Z. P. Huang, and J. X. Wang, A unified scheme for prediction of effective moduli of multiphase composites with interface effects: Part II—Application and scaling laws. *Mechanics of Materials* 39(1), 94–103 (2007).
 67. H. L. Duan, X. Yi, Z. P. Huang, and J. X. Wang, A unified scheme for prediction of effective moduli of multiphase composites with interface effects. Part I: Theoretical framework. *Mechanics of Materials* 39(1), 81–93 (2007).
 68. H. L. Duan, B. L. Karihaloo, J. X. Wang, and X. Yi, Compatible composition profiles and critical sizes of alloyed quantum dots. *Physical Review B* 74(19), 195328 (2006).
 69. H. L. Duan, B. L. Karihaloo, X. Yi, and J. X. Wang, Conductivities of heterogeneous media with graded anisotropic constituents. *Journal of Applied Physics* 100(3), 034906 (2006).
 70. H. L. Duan, Y. Jiao, X. Yi, Z. P. Huang, and J. X. Wang, Solutions of inhomogeneity problems with graded shells and application to core-shell nanoparticles and composites. *Journal of the Mechanics and Physics of Solids* 54(7), 1401–1425 (2006).
 71. H. L. Duan, B. L. Karihaloo, J. X. Wang, and X. Yi, Strain distributions in nano-onions with uniform and non-uniform compositions. *Nanotechnology* 17(14), 3380–3387 (2006).
 72. H. L. Duan, X. Yi, Z. P. Huang, and J. X. Wang, Eshelby equivalent inclusion method for composites with interface effects. *Key Engineering Materials* 312, 161–166 (2006).
 73. H. L. Duan, B. L. Karihaloo, J. X. Wang, and X. Yi, Effective conductivities of heterogeneous media containing multiple inclusions with various spatial distributions. *Physical Review B* 73(17), 174203 (2006).
 74. J. X. Wang, H. L. Duan, and X. Yi, Bounds on effective conductivities of heterogeneous media with graded constituents. *Physical Review B* 73(10), 104208 (2006).