

Utkur Mirsaidov

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Education:

Ph.D. Physics, The University of Texas-Austin, USA. (December 2005)
B.S. Physics, The University of Texas-Austin, USA. (May 2000)

Employment:

06/2019 – present Associate Professor,
05/2020 – present co-Director for the Centre for Bioluminescence Sciences,
08/2013 – 06/2019 Assistant Professor,
Department of Physics, National University of Singapore.
Department of Materials Science & Engineering, National University of Singapore.
Department of Biological Sciences, National University of Singapore.
Centre for Advanced 2D Materials, National University of Singapore.
Center for Bioluminescence Sciences, National University of Singapore.
NUS Nanoscience and Nanotechnology Institute.

2009-2013:
Research Fellow
MechanoBiology Institute, NUS.

2006-2008:
Postdoctoral Research Fellow
Department of Electrical Engineering & Beckman Institute for Advanced Science and Technology. The University of Illinois at Urbana-Champaign.

Awards:

The Nanotechnology Physics Medal, Institute of Physics-Singapore, 2016
NUS Young Scientist Award, 2016
NUS Young Investigator Award, 2014

Research Interest:

Development and application of advanced electron microscopy techniques (*in situ* liquid & gas phase TEM, cryo-TEM, and computational tools), physics and chemistry at interfaces, Nanoscience, energy storage materials and devices, catalysis, and soft-matter.

Research Grants:

As a Lead Principal Investigator:

1. Singapore National Research Foundation Competitive Research Grant-23 (S\$5,725,600; 1/05/2021-31/04/2025). – awarded (4 co-PIs)
2. Singapore Ministry of Education Academic Research Fund Tier 2 (S\$900,080; 10/05/2021-9/04/2024).- ongoing
3. Singapore Ministry of Education Academic Research Fund Tier 2 (S\$831,234; 1/02/2019-31/01/2022).- ongoing
4. Singapore Ministry of Education Academic Research Fund Tier 2 (S\$753,384; 31/07/2017-1/02/2020).- ongoing
5. Singapore National Research Foundation Competitive Research Grant-16 (1/11/2016-30/10/2020). – ongoing (S\$8,200,000 as a lead PI with 4 co-PIs)
6. Singapore Ministry of Education Academic Research Fund Tier 2 (S\$681,600; 2/02/2016-1/02/2019).- completed
7. ThermoFisher Scientific, Inc., Discovery Innovation Grant (S\$123,264; 1/09/2015-31/08/2016).- completed
8. NUS Young Investigator Award-2014 (S\$500,000; 15/02/2015-15/02/2020).- completed

As a co-Principal Investigator:

1. Singapore National Research Foundation Competitive Research Grant-22 (1/08/2020-31/07/2025). – awarded (10 co-PIs)
2. NUS-Applied Materials Corporate Lab Grant (1/04/2018-31/03/2023). – (8 co-PIs)
3. Singapore National Research Foundation Competitive Research Grant-13 (1/06/2015-31/05/2020). – ongoing (10 co-PIs)
4. Singapore National Research Foundation Competitive Research Grant-9 (1/03/2013-31/08/2016). – completed (4 co-PIs)

Publications:

1. X. Liu, S.-W. Chee, S. Raj, M Sawczyk, P. Kral, U. Mirsaidov, "Three-Step Nucleation of Metal-Organic Framework Nanocrystals." **Proceedings of National Academy of Sciences U.S.A.** 118(10), p. e2008880118 (2021)
2. U. Anand, T. Ghosh, Z. Aabdin, N. Vrancken, H. Yan, X. M. Xu, F. Holsteyns, U. Mirsaidov, "Deep Learning-Based High Throughput Inspection in 3D Nanofabrication and Defect Reversal in Nanopillar Arrays: Implications for Next Generation Transistors." **ACS Applied Nano Materials** 4(3), p.2664-2672 (2021).
3. Y. Jiang, L. Wang, M. Meunier, U. Mirsaidov, "Formation Pathways of Porous Alloy Nanoparticles through Selective Chemical and Electrochemical Etching." **Small** xx(xx), p.xxxx-xxxx (2021) (accepted).
4. W. Wang, I Erofeev, H. Yan, P Nandi, U. Mirsaidov, "Evolution of Anisotropic Arrow Nanostructures during Controlled Overgrowth." **Advanced Functional Materials** xxx(xx), p.2008639 (2021)
5. W. Wang, H. Yan, U. Anand, U. Mirsaidov, "Visualizing the Conversion of Metal-Organic Framework Nanoparticles into Hollow Layered Double Hydroxide Nanocages." **Journal of American Chemical Society** 143(4), p.1854-1862 (2021).
6. D. Andreeva, M. Trushin, A. Nikitina, M. Costa, P. Cherepanov, M. Holwill, S.

- Chen, K. Yang, S. W. Chee, U. Mirsaidov, A. C. Neto, K. Novoselov, "Two-dimensional Adaptive Membranes with Programmable Water and Ionic Channels." **Nature Nanotechnology** 16, p.174-180 (2021).
7. X. Li, H.-S. Xu, K. Leng, S. W. Chee, X. Zhao, N. Jain, H. Xu, J. Qiao, Q. Gao, I.-H. Park, S.-Y. Quek, and U. Mirsaidov, K. P. Loh "Partitioning the Interlayer Space in Covalent Organic Frameworks by Embedding Pseudorotaxane Moieties." **Nature Chemistry** 12, p.1115–1122 (2020).
8. U. Mirsaidov, J. Patterson, H. Zheng, "Liquid phase transmission electron microscopy for imaging of nanoscale processes in solution" **MRS Bulletin** 45(9), p.704-712 (2020). (link) Special Issue on Liquid Phase TEM.
9. S. W. Chee, J. Arce-Ramos, W. Li, A. Genest, U. Mirsaidov, "Structural Changes in Noble Metal Nanoparticles during CO Oxidation and Their Impact on Catalyst Activity" **Nature Communications** 11, p.2133 (2020).
10. N. Vrancken, T. Ghosh, U. Anand, Z. Aabdin, S. W. Chee, Zh. Baraissov, H. Terry, S. DeGendt, Z. Tao, X. M. Xu, F. Holsteyns, U. Mirsaidov, "Nanoscale Elastocapillary Effect Induced by Thin-Liquid-Film Instability." **Journal of Physical Chemistry Letters** 11(7), p.2751-2758 (2020).
11. X. Li, J. Qiao, S. W. Chee, H.-S. Xu, X. Zhao, H. S. Choi, W. Yu, S. Y. Quek, U. Mirsaidov, K. P. Loh, "Rapid, Scalable Construction of Highly Crystalline Acylhydrazone Two-dimensional Covalent Organic Frameworks via Dipole-Induced Antiparallel Stacking." **Journal of American Chemical Society** 142(10), p.4932-4943 (2020).
12. F. Panciera, Zh. Baraissov, G. Patriarche, V. Dubrovskii, F. Glas, L. Travers, U. Mirsaidov, J.-C. Harmand, "Phase selection in self-catalysed GaAs nanowires." **Nano Letters** 20(3), p.1669-1675 (2020).
13. L. Yang, P. Nandi, Y. Ma, J. Liu, U. Mirsaidov, H. Zhifeng, "Binary Chiral Nanoparticles Exhibit Amplified Optical Activity and Enhanced Refractive Index Sensitivity." **Small** 16(6), p.1906048 (2020).
14. X. Wang, H. Wu, S. Xi, W.-S. V. Lee, J. Zhang, Z. Wu, J. Wang, T. Hu, L. Liu, Y. Han, S. W. Chee, S. Ning, U. Mirsaidov, Z. Wang, Y.-W. Zhang, A. Borgna, J. Wang, Y. Du, Z. G. Yu, S. Pennycook, J. Xue, "Strain Stabilized Nickel hydroxide Nanoribbons for Efficient Water Splitting." **Energy & Env. Sci.** 13(1), p.229-237 (2020).
15. Y. Qu, S. W. Chee, M. Duchamp, S. Campbell, G. Zoppi, V. Barrioz, Y. Giret, T. Penfold, A. Chaturvedi, U. Mirsaidov, N. Beattie, "Real-time electron nanoscopy of photovoltaic absorber formation from kesterite nanoparticles." **ACS Applied Energy Materials** 3(1), p.120-128 (2020).
16. J. Liu, Z. Ni, P. Nandi, U. Mirsaidov, H. Zhifeng, "Chirality Transfer in Galvanic Replacement Reactions." **Nano Letters** 19(10), 7427-7433 (2019).
17. S. F. Tan, S. W. Chee, Z. Baraissov, J. Hongmei, T.-L. Tan, U. Mirsaidov, "Intermediate Structures of Pt–Ni Nanoparticles during Selective Chemical and Electrochemical Etching." **J. Phys. Chem. Lett.** 10(20), 6090-6096 (2019).
18. Z. Baraissov, A. Pacco, S. Koneti, G. Bisht, F. Panciera, F. Holsteyns, U. Mirsaidov, "Selective Wet-Etching of Silicon Germanium in Composite Vertical Nanowires." **ACS. Appl Mater Interfaces.** 11(40), 36839-36846 (2019).
19. Z. Baraissov, F. Panciera, L Travers, J. C. Harmand, U. Mirsaidov, "Growth Dynamics of Gallium Nanodroplets Driven by Thermally Activated Surface Diffusion." **J.**

Phys. Chem. Lett. 10(17), 5082-5089 (2019).

20. S. F. Tan, S. W. Chee, J. Hongmei, Z. Baraissov, T.-L. Tan, U. Mirsaidov, "Real-Time Imaging of Nanoscale Redox Reactions over Bimetallic Nanoparticles." **Advanced Functional Materials** 29(37), 1903242 (2019).
21. S. W. Chee, Z. Wong, Z. Baraissov, S. F. Tan, T.-L. Tan, U. Mirsaidov, "Interface Mediated Kirkendall Effect and Nanoscale Void Migration in Bimetallic Nanoparticles During Interdiffusion." **Nature Communications** 10, 2832 (2019).
22. S. W. Chee, U. Anand, G. Bisht, S. F. Tan, U. Mirsaidov, "Direct Observations of the Rotation and Translation of Anisotropic Nanoparticles Adsorbed at a Liquid-Solid Interface." **Nano Letters** 19(5), 2871-2878 (2019).
23. C. Li, C. Tho, D. Galaktionova, C. Xin, P. Kral, U. Mirsaidov, "Dynamics of Amphiphilic Block Copolymers in an Aqueous Solution: Direct Imaging of Micelle Formation and Nanoparticle Encapsulation." **Nanoscale** 11(5), 2299-2305 (2019).
24. M.-Q. Yang, L. Shen, Y. Lu, S. W. Chee, X. Lu, X. Chi, Z. Chen, Q.-H. Xu, U. Mirsaidov, G. W. Ho, "Disorder Engineering in Monolayer Nanosheets Enabling Photothermic Catalysis for Full Solar Spectrum Harvesting." **Angew. Chem. Int. Ed.** 58(10) p.3077-3081 (2019).
25. S. F. Tan, G. Bisht, U. Anand, M. Bosman, X. E. Yong, U. Mirsaidov, "In situ Kinetic and Thermodynamic Growth Control of Au-Pd Core-Shell Nanoparticles." **Journal of American Chemical Society** 140(37), 11680-11685 (2018).
26. X. Tian, U. Anand, U. Mirsaidov, H. Zheng, "Spontaneous reshaping and splitting of AgCl nanocrystals under electron beam illumination." **Small** 14(48), 1803231 (2018).
27. S. F. Tan, S. Raj, G. Bisht, H. Annadata, C. Nijhuis, P. Král, U. Mirsaidov, "Nanoparticle Interactions Guided by Shape-Dependent Hydrophobic Forces." **Advanced Materials** 30(16), 1707077 (2018).
28. D. Loh, S. Soumyo, M. Bosman, S. F. Tan, C. A. Nijhuis, P. Král, P. Matsudaira, U. Mirsaidov, "Multi-step Nucleation of Nanocrystals." **Nature Chemistry** 9, 77-82 (2017).
29. S. W. Chee, S. F. Tan, Z. Baraissov, M. Bosman, U. Mirsaidov, "Direct Observation of the Nanoscale Kirkendall Effect During Galvanic Replacement Reactions" **Nature Communications** 8, 1224 (2017).
30. E. Miele, S. Raj, Zh. Baraissov, P. Král, U. Mirsaidov, "Dynamics of Templated Assembly of Nanoparticle Filaments within Nanochannels." **Advanced Materials** 29(37), 1702682 (2017).
31. S. F. Tan, S. W. Chee, G. Lin, U. Mirsaidov, "Direct Observation of Interactions between Nanoparticles and Nanoparticle Self-Assembly in Solution." **Acc. Chem. Res.** 50(6), 1303-13012 (2017).
32. Z. Aabdin, X. M. Xu, S. Sen, U. Anand, P. Král, F. Holsteyns, U. Mirsaidov, "Transient Clustering of Reaction Intermediates During Wet Etching of Silicon Nanostructures." **Nano Lett.** 17(5), 2953-2958 (2017).
33. S. F. Tan, U. Anand, and U. Mirsaidov, "Interactions and Attachment Pathways between Functionalized Gold Nanorods." **ACS Nano** 11 (2), 1633-1640 (2017).

34. X. Tian, H. Zheng, U. Mirsaidov, "Aggregation Dynamics of Nanoparticles at Solid-Liquid Interface." **Nanoscale** 9, 10044-10050 (2017).
35. S. W. Chee, Z. Baraissov, N. D. Loh P. Matsudaira, and U. Mirsaidov, "Desorption-Mediated Motion of Nanoparticles at the Liquid-Solid Interface." **J. Phys Chem. C** 120(36), 20462–20470 (2016).
36. G. Lin, S.W. Chee, S. Raj, P. Král, U. Mirsaidov, "Linker-Mediated Self-Assembly of Charged Nanoparticles." **ACS Nano** 10(8), 7443-7450 (2016).
37. S.F. Tan, G. Lin, G. Lin, M. Bosman, U. Mirsaidov, and C. A. Nijhuis, "Real-Time Dynamics of Galvanic Replacement Reactions of Silver Nanocubes and Au Studied by Liquid-Cell Transmission Electron Microscopy." **ACS Nano** 10(8), 7689-7695 (2016).
38. S.-F. Tan, S. W. Chee, G. Lin, M. Bosman, M. Lin, U. Mirsaidov, C. A. Nijhuis, "Real-Time Imaging of the Formation of Au-Ag Core-Shell Nanoparticles." **J. Am. Chem. Soc.** 138(16), 5190-5193 (2016).
39. C. O'Regan, X. Zhu, Z. Jun, U. Anand, H. Su, U. Mirsaidov, "CTAB-Influenced Electrochemical Dissolution of Silver Dendrites." **Langmuir** 32(15), 3601-3607 (2016).
40. U. Anand, J. Lu, D. Loh, Z. Aabdin, U. Mirsaidov, "Hydration Layer-mediated Pairwise Interaction of Nanoparticles." **Nano Lett.** 16(1), 786–790 (2016).
41. G. Lin, X. Zhu, U. Anand, Q. Liu, J. Lu, H. Su, U. Mirsaidov, "Nanodroplet-Mediated Assembly of Platinum Nanoparticle Rings in Solution." **Nano Lett.** 16(2), 1092–1096 (2016).
42. Q. Liu, F. Y. Leong, Z. Aabdin, U. Anand, T. S. B. Quang, U. Mirsaidov, "Nanodroplet depining from nanoparticles." **ACS Nano** 9(9), 9020–9026 (2015).
43. T. S. B. Quang, F. Y. Leong, U. Mirsaidov, "Numerical study of homogeneous nanodroplet growth." **J. Colloid Interface Sci.** 438, 47-54 (2015).
44. Z. Aabdin, J. Lu, X. Zhu, U. Anand, N. Loh, H. Su, U. Mirsaidov, "Bonding pathways of gold nanocrystals in solution" **Nano Lett.** 14(11), 6639-6643 (2014).
45. J. Lu, Z. Aabdin, D. Loh, D. Bhattacharya, U. Mirsaidov, "Nanoparticle dynamics in a nanodroplet" **Nano Lett.** 14(4), 2111-2115 (2014).
46. D. Bhattacharya, M. Bosman, F.-Y. Leong, U. Mirsaidov, "Nucleation of water nanodroplet." **Microsc. Microanal.** 20, 407-415 (2014).

Before 2014:

47. F.-Y. Leong, U. Mirsaidov, P. Matsudaira, L. Mahadevan, "Dynamics of a nanodroplet under a transmission electron microscope." **Phys. Fluids** 26, 012003 (2014).
48. T-W. Huang, S-H. Liu, Y-J. Chuang, H-Y. Hsieh, C-Y. Tsai, W-J. Wu, C-T. Tsai, U. Mirsaidov, P. Matsudaira, C-S. Chang, F-G. Tseng, F-R. Chen, "Dynamics of Hydrogen Nanobubbles in KLH Protein Solution Studied with In-Situ Wet-TEM." **Soft Matter** 9, 8856-8861 (2013).
49. U. Mirsaidov, V.R.S.S. Mokkaapati, D. Battacharya, H. Andersen, M. Bosman, B. Ozyilmaz, P. Matsudaira, "Scrolling graphene into Nanofluidic channels." **Lab Chip** 13, 2874-2878 (2013).

50. H. Zheng, U. Mirsaidov, L.-W. Wang, P. Matsudaira, "Electron beam manipulation of nanoparticles." **Nano Lett.** 12, 5644-5648 (2012).
51. U. Mirsaidov, H. Zheng, D. Bhattacharya, Y. Casana, P. Matsudaira, "Direct observation of the stick-slip movement of nanometer-size water droplets induced by electron beam." **Proc. Natl. Acad. Sci. U.S.A.** 109(19), 7187-7190 (2012).
52. U. Mirsaidov, C. D. Ohl, P. Matsudaira, "A direct observation of nanovoid formation in ultrathin water film." **Soft Matter** 8(27), 3108-3111 (2012).
53. U. Mirsaidov, H. Zheng, Y. Casana, P. Matsudaira, "Imaging protein structure in water at 2.7 nm resolution by TEM." **Biophys. J.** 102, L15-L17 (2012).
54. T-W. Huang, S-H. Liu, Y-J. Chuang, H-Y. Hsieh, C-Y. Tsai, Y-T Huang, U. Mirsaidov, P. Matsudaira, F-G. Tseng, C-S. Chang, F-R. Chen, "Self-Aligned Wet-Cell for Hydrated Microbiology Observation in TEM." **Lab Chip** 12, 340-347 (2012).
55. G. Timp, U. Mirsaidov, et al., "3rd Generation DNA Sequencing with a Nanopore." chapter in *Nanopores: Sensing and Fundamental Biological Interactions*. Eds. Rashid Bashir and Samir M. Iqbal. (Springer: ISBN: 978-1-4419-8251-3). (2011)
56. U. Mirsaidov, S. Timashev, Y. Polyakov, P. Misurkin, I. Musaev, S. Polyakov, "Analytical Method for parameterizing the random profile components of nanosurfaces imaged by atomic force microscopy" **Analyst** 136, 570-576 (2011).
57. U. Mirsaidov, V. Dimitrov, J. Commer, D. Wang, A. Aksementiev, G. Timp. "Slowing the translocation of double stranded DNA using a nanopore smaller than the double helix." **Nanotechnology** 21, 395501 (2010).
58. W. Timp, U. Mirsaidov, D. Wang, J. Comer, O. Aksementiev, "Nanopore Sequencing: Electrical Measurements of the Code of Life" **IEEE Trans Nanotechnol** 9, 281-294 (2010).
59. U. Mirsaidov, D. Wang, W. Timp, G. Timp, "Molecular Diagnostics for Personal Medicine using a Nanopore." **Nanomed Nanobiotechnol.** 2, 367-381 (2010).
60. V. Dimitrov, U. Mirsaidov, D. Wang, T. Sorsch, W. Mansfield, J. Miner, F. Klemens, S. Yemenicioglu, G. Timp "Solid-State Nanopores in solid-state membranes engineered for Single Molecule Detection." **Nanotechnology** 21, 065502 (2010).
61. B. Dorvel, G. Sigalov, Q. Zhao, J. Comer, V. Dimitrov, U. Mirsaidov, A. Aksementiev, G. Timp, "Analyzing the Forces Binding a Restriction Endonuclease to DNA Using a Synthetic Nanopore." **Nucleic Acids Res.** 37(12) 4170-4179 (2009).
62. U. Mirsaidov, W. Timp, V. Dimitrov, X. Zou, K. Schulten, A. Feinberg, G. Timp, "Nanoelectromechanics of Methylated DNA in a Synthetic Nanopore." **Biophys. J.** 96(4), L32-L34 (2009).
63. W. Timp, U. Mirsaidov, P. Matsudaira, G. Timp, "Jamming prokaryotic cell-to-cell communication in a model biofilm." **Lab Chip** 9, 925-934 (2009).
64. U. Mirsaidov, J. Scrimgeour, W. Timp, M. Mir, P. Matsudaira, G. Timp, "Live Cell Lithography: Using optical tweezers to create synthetic tissue." **Lab Chip** 8, 2174-2181 (2008).
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73. C. Miller, U. Mirsaidov, T. Messina, Y. Lee, and J. Markert, "External Field effects on the resonant frequency of magnetically capped oscillators for magnetic resonance force microscopy." *J. Appl. Phys.* **93**, 6572-6574 (2003).

Patents:

Patent Title: "Detecting and *Sorting of Methylated DNA Using a Synthetic Nanopore.*" US2012/0040343, US8394584, WO2010080617A2, WO2010080617A3. (*Licensed* to Oxford Nanopore Technologies).

Patent Title: "Characterizing Stretched Polynucleotides in a Synthetic Nano-passage." US2011/0226623, US8748091. (*Licensed* to Oxford Nanopore Technologies).