Professor Dr. Ke Du
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RESEARCH INTERESTS

My lab seeks to understand and exploit biomarkers capture and sensing with micro- and nanodevices. Current research activities include but not limited to: biosensing, bio-MEMS, CRISPR, optofluidics, mechanobiology, nanopore sequencing, scalable nanomanufacturing, functional nanomaterials, and artificial intelligence

I am supervising 1 postdoc researcher, 5 Ph.D. students, 2 M.S. students, and 3 undergraduate students. More information can be found on our website: **www.3nartit.com**

EDUCATION

Postdoc in Bioengineering, University of California, Berkeley, 2015-2018
Ph.D. in Mechanical Engineering, Stevens Institute of Technology, 2009-2015
M.S. in Mechanical Engineering, University of South Florida, 2007-2009
B.S. in Materials Physics, 2007, University of Science and Technology, Beijing, 2003-2007

PROFESSIONAL EXPERIENCE

Assistant Professor, Mechanical Engineering, Rochester Institute of Technology, 2018 – now
Assistant Professor, Microsystems Engineering, Rochester Institute of Technology, 2018 – now
Adjunct Faculty, Engineering, Diablo Valley College, 2016 – 2018

HONORS / AWARDS

- Rising star in sensing, *ACS Sensors*, 2020
- Finalist, Microsystems and Nanoengineering Young Scientist Awards, 2020
- Burroughs Wellcome Fund, 2019
- *Biosensors* Travel Award (only one awardee worldwide), 2017
- *Micromachines* Travel Award (two awardees worldwide), 2017
- James H. Potter Award, 2014
- NSF Graduate Student Fellowship, 2012

INDEPENANT RESEARCH FEATURED BY UNIVERSITY NEWS

Stevens News: His Quest to Diagnose COVID-19 and Contain Future Pandemics
RIT News: RIT professor develops device to better detect Ebola virus
RIT News: RIT researchers build micro-device to detect bacteria, viruses
Rutgers Today: New Device Quickly Detects Harmful Bacteria in Blood

INVITED TALKS

- University of Buffalo (online presentation), Nov. 2020
- UIUC-ZJU (online presentation), Apr. 2020
- University of Rochester, Mar. 2020
- Binghamton University, Feb. 2020
- Corning Inc., Feb. 2020
- Rutgers, The State University of New Jersey, Oct. 2019
- National Institute of Standards and Technology, Jun. 2019
- Stevens Institute of Technology, Apr. 2019

Professional SERVICES

- Editor Board Member, *Micromachines*, 2020 – now
- Reviewer Board Member, *Biosensors*, 2020 – now
- Symposium Organizer, ACS Northeast Regional Meeting, 2020
- Proposal Reviewer, The Leverhulme Trust, 2020
- Panelist, CMMI, The National Science Foundation, 2019
- Proposal Reviewer, The Innovation and Technology Commission (ITC) of Hong Kong, 2019

- Proposal Panelist, Center of Functional Nanomaterials (CFN), Brookhaven National Laboratory, 2019
- Session Chair, The 63rd International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), 2019
- Session Chair, ASME International Mechanical Engineering Congress & Exposition, 2019
- Guest Editor, Micromachines, special issue of "Scalable Micro/Nano Patterning", 2016
- Member of the program committee for the EIPBN conference, 2011-2014
- Member of the organizing committee for the 2012 BNL Young Research Symposium
- Invited reviewer for over twenty peer-reviewed journals, including *Nature Biomedical Engineering, ACS Applied Materials & Interfaces, ACS Biomaterials Science & Engineering, Analytical Chemistry, Advanced Functional Materials, Advanced Materials, Advanced Materials Technologies, ACS Sensors, Biosensors and Bioelectronics*, *Diagnostics, Frontiers of Chemistry, Journal of Micromechanics and Microengineering, Journal of Vacuum Science and Technology A, Journal of Vacuum Science and Technology B, Langmuir, Lab on Chip, Micromachines, Microfluidics and Nanofluidics, Optics Letters, Pathogens, Sensors and Actuators A*, *Sensors and Actuators B*, *Scientific Reports*, *Trends in Analytical Chemistry, Nanotechnology, and Nanoscale Research Letters*

TEACHING EXPERIENCE

Instructor for Heat Transfer, Rochester Institute of Technology, 2018 – now
Adjunct Instructor for several engineering courses, Diablo Valley College, 2017 – 2018

BOOK CHAPTER (*denoting corresponding author)

Hass, K., Xu, Z., Hu, H., Yao, B., Yuan, X., Wang, C., Qin, P., and **Du, K***. Recent advances in nucleic acid analysis and detection with micro-and nanofluidics, for the book titled Multidisciplinary microfluidic/nanofluidic lab-on-a-chip: principles & applications, Elsevier, in press.

JOURNAL PUBLICATIONS

Google scholar citation > 740; h-index: 17 (updated October 2020)
https://scholar.google.com/citations?user=rli9MC0AAAAJ&hl=en

After joining RIT:

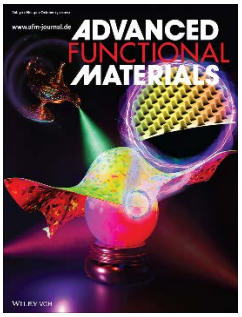
1) Bao, M., Yang, F., Chen, J., He, Qian, Chang, Y., Hass, K., Qin, P., and **Du, K***. Recent advances of rapid diagnosis of viral hemorrhagic fevers (VHFs), in preparation.

2) Layouni, R., Dubrovsky, M., Bao, M., Chung H., **Du, K**., Boriskina S., Weiss, S., and Vermeulen, D. High contrast probe cleavage detection on porous silicon biosensors via quantum dot labeled DNA probes, in revision.

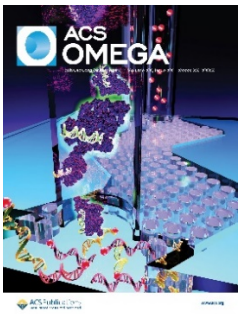
3) Yang, J., He, Y., Zhang, X., Yang, W., Li, Y., Chen, Q., Chen, X., and **Du, K**. Improvement of Electrical Conductivity of Copper/Graphene Composite by Reducing the Interfacial Impurities, in preparation.

4) Chen, X., Zhang, S., Gan, Y., Li, T., Liu, R., Wang, R., Lapizco-Encinas, B., and **Du, K***. Understanding the deformable microfluidics via microbeads stacking and its role in plasma separation and blood cells retrieval, in preparation.

5) Liu, Y[†]., **Du, K[†]**., Wathuthanthri, I., Xu, W., and Choi, C. Free-standing photoresist (PR) film: A versatile template for three-dimensional (3D) micro- and nanofabrication, *Advanced Functional Materials*, 30, 2004129. (Featured as inside front cover)
[†]: Equal contribution



6) Hass, K., Bao, M., He, Q., Liu, L., He, J., Park. M., Qin, P., and **Du, K***. (2020). Integrated micropillar polydimethylsiloxane accurate CRISPR detection (IMPACT) system for rapid viral DNA sensing, *ACS Omega*, 5 (42), 27433-27441. (Featured as supplementary cover)

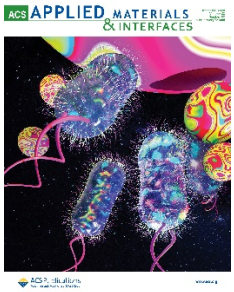


7) Yuan, X., Yang, C., He, Q., Yu, D., Li, J., Zhai, S., Qin, Z., **Du, K***., Chu, Z., and Qin, P. (2020). Current and perspective diagnostic techniques for COVID-19, *ACS Infectious Diseases*, 6 (8), 1998-2016. (Featured as supplementary cover)

8) Korensky, G., Chen, X., Bao, M., Hass, K., Miller, A., Lapizco-Encinas, B., and **Du, K***. Single molecule Chlamydomonas reinhardtii (CR) separation and auto-fluorescence monitoring via a nano-sieve channel, *Electrophoresis*, in press.

9) Bao, M., Jensen, E., Chang, Y., Korensky, G., and **Du, K***. (2020). Magnetic bead-quantum dot (MB-Qdot) clustered regularly interspaced short palindromic repeat assay for simple viral DNA detection, ***ACS** Applied Materials and Interfaces*, 12, 39, 43435-43443.

10) Chen, X., Miller, A., Cao, S., Yu, G., Zhang, J., He, Q., Wang, R., Yong, X., Qin, P., Lapizco-Encinas, B., and **Du, K*.** (2020). Efficient Escherichia coli trapping, concentrating, and retrieval via nano-sieve packed magnetic microbeads array, *ACS Applied Materials and Interfaces*, 12 (7), 7888-7896. (Featured as supplementary cover)
Media coverage: *Rutgers Today, *Nanowerk, *Science Daily, *The Medical News, *EurekAlert (press release)



11) He, Q., Bao, M., Hass, K., Lin, W., Qin, P*., and **Du, K***. (2019). Perspective of molecular diagnosis in healthcare: From barcode to pattern recognition, *Diagnostics*, 9, 75.

12) Chen, X., Falzon, L., Zhang, X., Wang, R*., and **Du, K***. (2020). Experimental and theoretical study on the microparticle trapping and release in a deformable nano-sieve channel, *Nanotechnology*, 31, 05LT01.

13) Qin, P., Park, M., Alfson, K., Tamhankar, M., Carrion, R., Patterson, J., Griffiths, A., Yildiz, A., Mathies, R., and **Du, K***. (2019). Rapid and fully microfluidic Ebola virus detection with CRISPR-Cas13a, ACS Sensors, 4 (4), 1048-1054. (Featured as supplementary cover)

Media coverage: *RIT news, *Yahoo Finance, *WHAM, *The Science Times, *EurekAlert (press release), *Materials Post, *News Medical Life Sciences, *R&D, *ERIE NEWS NOW, *WRCBtv, *Agenparl, *News9, *WFMJ

14) **Du, K**., Wathuthanthri, I., Ding, J., Choi, C. H. (2018). Superhydrophobic waveguide: Liquid-core air cladding waveguiding platform for optofluidics, *Applied Physics Letters*, 113, 143701.

Before joining RIT:

1) **Du, K**., Jiang, Y., Liu, Y., Wathuthanthri, I., and Choi, C. H. (2018). Manipulation of superhydrophobicity of plasma-etched polymer nanostructures. *Micromachines*, 9, 304.

2) **Du, K**., Jiang, Y., Huang, P., Ding, J., Gao, T., and Choi, C. H. (2018). Self-formation of polymer nanostructures in plasma etching: mechanisms and applications. *Journal of Micromechanics and Microengineering*, 28, 014006.

3) **Du, K**., Park, M., Griffiths, A., Carrion, R., Patterson, J., Schmidt, H., and Mathies, R. (2017). Microfluidics for the detection of Viral RNA in whole blood samples using digital-coded barcode fluorescence dye and photo-cleavable capture probe. *Analytical Chemistry*, 89 (22), 12433-12440.

4) **Du, K***., Park, M., Ding, J., Hu, H., and Zhang, Z. (2017). Sub-10 nm patterning with DNA nanostructures: a short perspective. *Nanotechnology*, 28, 442501.

5) **Du, K**., Ding, J., Wathuthanthri, I., and Choi, C. H. (2017). Selective hierarchical patterning of silicon nanostructures via soft stencil lithography. *Nanotechnology*, 28, 465303.

6) **Du, K**., Wathuthanthri, I., and Choi, C. H. (2017). The rise of scalable micro/nanopatterning. *Micromachines*, 8, 275.

7) Jiang, Y., Xu, J., Lee, J., **Du, K**., Yang, E. H., Moon, W., and Choi, C. H. (2017). Nanotexturing of conjugated polymers via one-step maskless oxygen plasma etching for enhanced tunable wettability. *Langmuir*, 33 (27), 6885-6894.

8) Chauvin, A., Stephant, N., **Du, K**., Ding, J., Wathuthanthri, I., Choi, C. H., Tessier, P. Y., and El Mel, A. A. (2017). Large-scale fabrication of porous gold nanowires via laser interference lithography and dealloying of gold-silver nano-alloys. *Micromachines*, 8, 168.
*Feature paper

9) Du, K., Ding, J., Liu, Y., Wathuthanthri. I., and Choi, C. H. (2017). Stencil lithography for scalable micro- and nanomanufacturing. Micromachines, 8, 131.

*Highlighted by Microfluidic Technology Review

10) **Du, K**., Cai, H., Park, M., Wall, T., Stott, M., Alfson, K., Griffiths, A., Carrion, R., Patterson, J., Hawkins, A., Schmidt, H., and Mathies, R. (2017). Multiplexed on-chip sample preparation and sensitive detection of Ebola virus. *Biosensors and Bioelectronics*, 91, 489-496.

11) El Mel, A. A., Chettab, M., Gautron, E., Chauvin, A., Humbert, B., Mevellec, J. Y., Cyril, D., Thiry, D., Stephant, N., Ding, J., **Du, K**., Choi, C. H., and Tessier, P. Y. (2016). Galvanic Replacement Reaction: A Route to Highly Ordered Bimetallic Nanotubes. *The Journal of Physical Chemistry C*. 120 (31), 17652-17659.

12) El Mel, A. A. E., Tessier, P. Y., Buffiere, M., Gautron, E., Ding, J., **Du, K**., Choi, C. H., Konstantinidis, E., Snyders, R., Bittencourt, C., and Molina-Luna, L. (2016). Controlling the Formation of Nanocavities in Kirkendall Nanoobjects through Sequential Thermal Ex Situ Oxidation and In Situ Reduction Reactions. *Small*, 12 (21), 2885-2892.

13) Chauvin, A., Delacôte, C., Molina-Luna, L., Duerrschnabel, M., Boujtita, M., Thiry, **Du, K**., Ding, J., Choi, C. H., Tessier, P. Y., and El Mel, A. A. (2016). Planar arrays of nanoporous gold nanowires: when electrochemical dealloying meets nanopatterning. *ACS Applied Materials & Interfaces*, 8 (10), 6611-6620.

14) Thiry, D., Molina-Luna, L., Gautron, E., Stephant, N., Chauvin, A., **Du, K**., Ding, J., Choi, C. H., Tessier, P.Y., and El Mel, A. A. (2015). The Kirkendall Effect in Binary Alloys: Trapping Gold in Copper Oxide Nanoshells. *Chemistry of Materials*, 27 (18), 6374-6384.

15) **Du, K**., Wathuthanthri, I., Liu, Y., Kang, Y. T., and Choi, C. H. (2014). Fabrication of polymer nanowires via maskless O2 plasma etching. Nanotechnology, 25 (16), 165301. (Featured as cover article)

16) Ding, J., **Du, K**., Wathuthanthri, I., Choi, C. H., Fisher, F. T., and Yang, E. H. (2014). Transfer patterning of large-area graphene nanomesh via holographic lithography and plasma etching. *Journal of Vacuum Science & Technology B*, 32 (6), 06FF01.
*Most read JVST article
*Editor's pick

17) El Mel, A. A., Molina-Luna, L., Buffiere, M., Tessier, P. Y., **Du, K**., Choi, C. H., Kleebe, H. J., Konstantinidis, S., Bittencourt, C., and Snyders, R. (2014). Electron Beam Nanosculpting of Kirkendall Oxide Nanochannels. *ACS Nano*, 8 (2), 1854-1861.

18) **Du, K**., Liu, Y., Wathuthanthri, I., and Choi, C. H. (2013). Fabrication of hierarchical nanostructures using free-standing trilayer membrane. *Journal of Vacuum Science & Technology B*, 31 (6), 06FF04.

19) Wathuthanthri, I., Liu, Y., **Du, K**., Xu, W., and Choi, C. H. (2013). Simple Holographic Patterning for High-Aspect-Ratio Three-Dimensional Nanostructures with Large Coverage Area. *Advanced Functional Materials*, 23 (5), 608-618.

20) Lu, Y., Sarshar, M. A., **Du, K**., Chou, T., Choi, C. H., and Sukhishvili, S. A. (2013). Large-amplitude, reversible, pH-triggered wetting transitions enabled by layer-by-layer films. *ACS Applied Materials & Interfaces*, 5 (23), 12617-12623.

21) **Du, K**., Wathuthanthri, I., Liu, Y., Xu, W., and Choi, C. H. (2012). Wafer-Scale pattern transfer of metal nanostructures on polydimethylsiloxane (PDMS) substrates via holographic nanopatterns. *ACS Applied Materials & Interfaces*, 4 (10), 5505-5514.

22) Liu, Y., **Du, K**., Wathuthanthri, I., and Choi, C. H. (2012). From nanocone to nanodisc: Structural transformation of gold nanoarrays via simple mechanical stresses. *Journal of Vacuum Science & Technology B*, 30 (6), 06FF10.

23) El Mel. A. A., Buffière, M., Tessier, P. Y., Konstantinidis, S., Xu, W., **Du, K**., Wathuthanthri, I., Choi, C. H., Bittencourt, C., and Snyders, R. (2013). Highly ordered hollow oxide nanostructures: the kirkendall effect at the nanoscale. *Small*, 9 (17), 2838-2843. (Featured frontispiece)

24) **Du, K**., Liu, Y., Wathuthanthri, I., and Choi, C. H. (2012). Dual applications of free-standing holographic nanopatterns for lift-off and stencil lithography. *Journal of Vacuum Science & Technology B*, 30 (6), 06FF04.

25) **Du, K**., Wathuthanthri, I., Mao, W., Xu, W., and Choi, C. H. (2011). Large-area pattern transfer of metallic nanostructures on glass substrates via interference lithography. *Nanotechnology*, 22 (28), 285306. *Cited over 50 times

26) Locke, C., Kravchenko, G., Waters, P., Reddy, J. D., **Du, K**., Volinsky, A. A., Frewin, C. L., and Saddow, S. E. (2009). 3C-SiC films on Si for MEMS applications: mechanical properties. *Materials Science Forum* (Vol. 615, pp. 633-636). Trans Tech Publications.

SELECTED CONFERENCE PROCEEDINGS

1) Liu, Y., **Du, K**., Wathuthanthri, I., Xu, W., and Choi, C. H. (2012, January). 3-D nanofabrication using nanostructured photoresist film as free-standing appliqué. In Micro Electro Mechanical Systems (MEMS), 2012 IEEE 25th International Conference on (pp. 192-195).

2) Chauvin, A., Delacôte, C., Molina-Luna, L., Boujita, M., Thiry, D., **Du, K**., Ding, J., Choi, C. H., Humbert, B., Mevellec, J. Y., Tessier, P. Y., and El Mel, A. A. (2016, May). Two-step approach for the nanofabrication of highly ordered ultra-long porous gold nanowires with an adjustable porosity for SERS-based sensors. In 2016 TechConnect World Innovation Conference.

3) Volinsky, A. A., **Du, K**., and Lusk, C. (2009, May). Compliant MEMS Device Actuation and Fracture. In ICF12.

4) El Mel, A. A., Buffière, M., Tessier, P. Y., Xu, W., **Du, K**., Choi, C. H., Konstantinidis, S., Bittencourt, C., and Snyders, R. (2013, January). Fabrication of highly ordered hollow oxide nanostructures based on nanoscale Kirkendall effect and Ostwald ripening. In Nanoelectronics Conference (INEC), 2013 IEEE 5th International (pp. 46-48).

ONGING FUDNING SUPPORT

Biological Mimetics, Inc 09/15/2020-03/15/2021
A pilot study of quantum dot based CRISPR assay for SARS-CoV-2 detection. This project aims to develop a quantum dot based CRISPR assay for COVID detection.

Shenzhen Ruhan Gene Tech 01/02/2020-12/23/2020
Fabrication of Integrated Nanopore Platform for High-Throughput Sequencing. This project aims to develop a nanopores based biosensor for high-throughput DNA sequencing.

Colgate Palmolive 01/14/2020-01/15/2021
Bio-Fluids Movement in Biomemetic Microchannels. This project aims to fundamentally understand the saliva movement in microchannels under heat triggering.

Faculty Education and Development Grant 05/01/2019-04/30/2020
Hunting Deadly viruses with a portable multi-meter type diagnostic device: A response to the ongoing 2018 Kivu Ebola Outbreak. This research aims to construct a POC device combining automated microfluidics and “nano-gap” electrochemical sensor.

Burroughs Wellcome Fund (BWF) 07/15/2019-12/31/2020
Amplification-free Zika Sensing via urchin-inspired nanostructured point-of-care device. This research aims to get preliminary result of Zika RNA sensing with urchin-inspired nanostructures and continue the ongoing collaborations with TBRI.

COMPLETED PROJECTS

Epigenitas 05/06/2019-05/17/2019
Rapid and multidimensional pathogen detection with microfluidics and CRISPR Cas12a. This research aims to test the feasibility of using microfluidics and CRISPR Cas12a for rapid Zika RNA detection.

Seed Funding / RIT 05/01/2019-04/3/2020
Highly Efficient Capture and Detection of Deady Zaire Ebola virus (EBOV) via Polydimethylsiloxane (PDMS) Hierarchical Nanostructures. This project aims to leverage high-aspect ratio PDMS micro- and nanostructures for EBOV RNA capture and sensing.

UNTYE Pipeline-to-Pilot Award 08/01/2019-07/31/2020
CRISPR-Cas13a Enabled Sensitive optofluidics platform for Zika RNA sensing. This research aims to construct a Zika RNA sensing device combining liquid core waveguide with CRISPR technology.

SiPhox 05/30/2020-07/31/2020

Preparation of Gold-DNA and quantum dot-DNA probes for photonic detection of SARS-CoV-2. This project aims immobilize DNA probes on a waveguide ring resonator for future CRISPR detection.

SiPhox 07/08/2020-11/08/2020

A pilot study of CRISPR enabled photonic detection of viral DNA. This project aims to test an integrated photonic device for DNA sensing by using CRISPR-Cas12a assay and waveguide.