FARIBORZ KARGAR

Assistant Adjunct Professor and Project Scientist at Department of Electrical and Computer Engineering and Cooperating Faculty of Department of Chemical and Environmental Engineering, University of California – Riverside

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EDUCATION AND PROFESSIONAL PREPARATION

- Postdoctoral Scholar, University of California – Riverside, USA (Jan 2017-Dec 2018)
  Manager of Phonon Optimized Engineered Materials (POEM) Center and Nano-Device Laboratory (NDL)
- Ph.D. in Electrical Engineering, University of California – Riverside, USA (Sep 2013-Dec 2016)
  Dissertation: "Direct observation of confined acoustic phonon polarization branches in free-standing semiconductor nanowires"
- M.Sc. in Mechanical Engineering, K. N. Toosi University of Technology, Tehran, Iran (Sep 2007-Sep 2010)
  Thesis: "Analysis of effective parameters on momentum transport and thermal behavior of nano-fluids flowing in a circular tube via numerical investigation"
- B.Sc. in Mechanical Engineering, Iran University of Science and Technology, Tehran, Iran (Sep 2001-Sep 2006)

RESEARCH INTERESTS

Brillouin-Mandelstam and Raman spectroscopy; Phonon and magnon transport and phonon engineering in advanced materials and nanostructures; Thermal interface materials and composites for thermal management of electronic devices and packaging; Graphene and low-dimensional van der Waals materials.

EMPLOYMANT HISTORY

- Assistant Adjunct Professor (Jan 2019 – present), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), California, USA
- Project Scientist (Jan 2019 – present), Phonon Optimized Engineered Materials (POEM) center, Department of Electrical and Computer Engineering, University of California – Riverside (UCR), California, USA
- Postdoctoral Scholar (Jan 2017 – Dec 2018), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), California, USA
- Research Assistant (Sep 2013 – Dec 2016), Department of Electrical and Computer Engineering, University of California – Riverside (UCR), California, USA
- Director of Solar Research Group (Mar 2013-Sep 2013), Fotrousi Electronics Research Center, Tehran, Iran
- Research Engineer (Jan 2012 – Mar 2013), Fotrousi Electronics Research Center, Tehran, Iran
- Consulting Engineer (Jan 2012 – Mar 2013), Cielo Este S. L., Malaga, Spain
- Research Engineer (Sep 2010 – Jan 2012), Niroo Research Institute (NRI), Tehran, Iran

FUNDED RESEARCH PROJECTS

- Co-PI (total award: $518,746): NSF Major Research Instrumentation Program; 10/1/2020 - 9/30/2022; Title: Development of a Cryogenic Integrated Micro-Raman-Brillouin-Mandelstam Spectrometer

LIST OF GRADUATED STUDENTS

- Dr. Chun-Yu Tammy Huang (PHD, MSE, 2019); Dissertation: "Phononic Metamaterials: Nanofabrication and Brillouin-Mandelstam Spectroscopy"
- Saba Seyedmahmoudbaraghani (PHD Candidate, CEE, To Be Graduated in 2020).

JOURNAL PUBLICATIONS

[1] C.Y.T. Huang, F. Kargar, T. Debnath, B. Debnath, M.D. Valentin, R. Synowicki, S. Schoeche, R.K. Lake, A.A. Balandin, Phononic and Photonic Properties of Shape-Engineered Silicon Nanoscale Pillar Arrays, Nanotechnology. 31 (2020) 30LT01. https://doi.org/10.1088/1361-6528/ab85ee.

[2] F. Kargar, M. Balinskiy, H. Chiang, A.C. Chavez, J. Nance, A. Khitun, G.P. Carman, A.A. Balandin, Brillouin-Mandelstam Spectroscopy of Stress-Modulated Spatially Confined Spin Waves in Ni Thin Films on Piezoelectric Substrates, J. Magn. Magn. Mater. 501 (2020) 166440. https://doi.org/10.1016/j.jmmm.2020.166440.

[3] F. Kargar, E.A. Coleman, S. Ghosh, J. Lee, M.J. Gomez, Y. Liu, A.S. Magana, Z. Barani, A. Mohammadzadeh, B. Debnath, R.B. Wilson, R.K. Lake, A.A. Balandin, Phonon and Thermal Properties of Quasi-Two-Dimensional $FePS_3$ and $MnPS_3$ Antiferromagnetic Semiconductors, ACS Nano. 14 (2020) 2424–2435. https://doi.org/10.1021/acsnano.9b09839.

[4] Z. Barani, A. Mohammadzadeh, A. Geremew, C.Y. Huang, D. Coleman, L. Mangolini, F. Kargar, A.A. Balandin, Thermal Properties of the Binary-Filler Hybrid Composites with Graphene and Copper Nanoparticles, Adv. Funct. Mater. 30 (2020) 1904008. https://doi.org/10.1002/adfm.201904008.

[5] Z. Barani, F. Kargar, K. Godziszewski, A. Rehman, Y. Yashchyshyn, S. Rumyantsev, G. Cywiński, W. Knap, A.A. Balandin, Graphene Epoxy-Based Composites as Efficient Electromagnetic Absorbers in the Extremely High-Frequency Band, ACS Appl. Mater. Interfaces. 12 (2020) 28635–28644. https://doi.org/10.1021/acsami.0c06729.

[6] Z. Barani, F. Kargar, A. Mohammadzadeh, S. Naghibi, C. Lo, B. Rivera, A.A. Balandin, Multifunctional Graphene Composites for Electromagnetic Shielding and Thermal Management at Elevated Temperatures, Adv. Electron. Mater. (2020) 2000520. https://doi.org/10.1002/aelm.202000520.

[7] S. Naghibi, F. Kargar, D. Wright, C.Y.T. Huang, A. Mohammadzadeh, Z. Barani, R. Salgado, A.A. Balandin, Noncuring Graphene Thermal Interface Materials for Advanced Electronics, Adv. Electron. Mater. 6 (2020) 1901303. https://doi.org/10.1002/aelm.201901303.

[8] J.S. Lewis, T. Perrier, A. Mohammadzadeh, F. Kargar, A.A. Balandin, Power Cycling and Reliability Testing of Epoxy-Based Graphene Thermal Interface Materials, C — J. Carbon Res. 6 (2020) 26. https://doi.org/10.3390/c6020026.

[9] B.K. Mahadevan, S. Naghibi, F. Kargar, A.A. Balandin, Non-Curing Thermal Interface Materials with Graphene Fillers for Thermal Management of Concentrated Photovoltaic Solar Cells, C — J. Carbon Res. 6 (2020) 2. https://doi.org/10.3390/c6010002.

[10] A.K. Geremew, S. Rumyantsev, F. Kargar, B. Debnath, A. Nosek, M.A. Bloodgood, M. Bockrath, T.T. Salguero, R.K. Lake, A.A. Balandin, Bias-Voltage Driven Switching of the Charge-Density-Wave and Normal Metallic Phases in 1T-TaS_2 Thin-Film Devices, ACS Nano. 13 (2019) 7231–7240. https://doi.org/10.1021/acsnano.9b02870.

[11] A.K. Geremew, F. Kargar, E.X. Zhang, S.E. Zhao, E. Aytan, M.A. Bloodgood, T.T. Salguero, S. Rumyantsev, A. Fedoseyev, D.M. Fleetwood, A.A. Balandin, Proton-Irradiation-Immune Electronics Implemented with Two-Dimensional Charge-Density-Wave Devices, Nanoscale. 11 (2019) 8380–8386. https://doi.org/10.1039/c9nr01614g.

[12] A. Geremew, C. Qian, A. Abelson, S. Rumyantsev, F. Kargar, M. Law, A.A. Balandin, Low-Frequency Electronic Noise in Superlattice and Random-Packed Thin Films of Colloidal Quantum Dots, Nanoscale. 11 (2019) 20171–20178. https://doi.org/10.1039/c9nr06899f.

[13] F. Kargar, Z. Barani, M. Balinskiy, A.S. Magana, J.S. Lewis, A.A. Balandin, Dual-Functional Graphene Composites for Electromagnetic Shielding and Thermal Management, Adv. Electron. Mater. 5 (2019) 1800558. https://doi.org/10.1002/aelm.201800558.

[14] B. Niu, T. Su, B.A. Francisco, S. Ghosh, F. Kargar, X. Huang, M. Lohmann, J. Li, Y. Xu, T. Taniguchi, K. Watanabe, D. Wu, A. Balandin, J. Shi, Y.T. Cui, Coexistence of Magnetic Orders in Two-Dimensional

Magnet CrI_3, Nano Lett. 20 (2019) 553–558. https://doi.org/10.1021/acs.nanolett.9b04282.
[15] S. Rumyantsev, M. Balinskiy, F. Kargar, A. Khitun, A.A. Balandin, The Discrete Noise of Magnons, Appl. Phys. Lett. 114 (2019) 090601. https://doi.org/10.1063/1.5088651.
[16] R. Salgado, A. Mohammadzadeh, F. Kargar, A. Geremew, C.-Y. Huang, M.A. Bloodgood, S. Rumyantsev, T.T. Salguero, A.A. Balandin, Low-Frequency Noise Spectroscopy of Charge-Density-Wave Phase Transitions in Vertical Quasi-2D 1T-TaS_2 Devices, Appl. Phys. Express. 12 (2019) 037001. https://doi.org/10.7567/1882-0786/ab0397.
[17] I.A. Shojaei, S. Linser, G. Jnawali, N. Wickramasuriya, H.E. Jackson, L.M. Smith, F. Kargar, A.A. Balandin, X. Yuan, P. Caroff, H.H. Tan, C. Jagadish, Strong Hot Carrier Effects in Single Nanowire Heterostructures, Nano Lett. 19 (2019) 5062–5069. https://doi.org/10.1021/acs.nanolett.9b01345.
[18] B. Wang, B. V. Cunning, N.Y. Kim, F. Kargar, S.-Y. Park, Z. Li, S.R. Joshi, L. Peng, V. Modepalli, X. Chen, Y. Shen, W.K. Seong, Y. Kwon, J. Jang, H. Shi, C. Gao, G.-H. Kim, T.J. Shin, K. Kim, J.-Y. Kim, A.A. Balandin, Z. Lee, R.S. Ruoff, Ultrastiff, Strong, and Highly Thermally Conductive Crystalline Graphitic Films with Mixed Stacking Order, Adv. Mater. (2019) 1903039. https://doi.org/10.1002/adma.201903039.
[19] J.S. Lewis, Z. Barani, A.S. Magana, F. Kargar, A.A. Balandin, Thermal and electrical Conductivity Control in Hybrid Composites with Graphene and Boron Nitride Fillers, Mater. Res. Express. 6 (2019) 085325. https://doi.org/10.1088/2053-1591/ab2215.
[20] M. Balinskiy, F. Kargar, H. Chiang, A.A. Balandin, A.G. Khitun, Brillouin-Mandelstam Spectroscopy of Standing Spin Waves in a Ferrite Waveguide, AIP Adv. 8 (2018) 056017. https://doi.org/10.1063/1.5007165.
[21] F. Kargar, Z. Barani, R. Salgado, B. Debnath, J.S. Lewis, E. Aytan, R.K. Lake, A.A. Balandin, Thermal Percolation Threshold and Thermal Properties of Composites with High Loading of Graphene and Boron Nitride Fillers, ACS Appl. Mater. Interfaces. 10 (2018) 37555–37565. https://doi.org/10.1021/acsami.8b16616.
[22] F. Kargar, E.H. Penilla, E. Aytan, J.S. Lewis, J.E. Garay, A.A. Balandin, Acoustic Phonon Dispersion Engineering in Bulk Crystals via Incorporation of Dopant Atoms, Appl. Phys. Lett. 112 (2018) 191902. https://doi.org/10.1063/1.5030558.
[23] E. Aytan, B. Debnath, F. Kargar, Y. Barlas, M.M. Lacerda, J.X. Li, R.K. Lake, J. Shi, A.A. Balandin, Spin-Phonon Coupling in Antiferromagnetic Nickel Oxide, Appl. Phys. Lett. 111 (2017) 252402. https://doi.org/10.1063/1.5009598.
[24] M.M. Lacerda, F. Kargar, E. Aytan, R. Samnakay, B. Debnath, J.X. Li, A. Khitun, R.K. Lake, J. Shi, A.A. Balandin, Variable-Temperature Inelastic Light Scattering Spectroscopy of Nickel Oxide: Disentangling Phonons and Magnons, Appl. Phys. Lett. 110 (2017) 202406. https://doi.org/10.1063/1.4983810.
[25] F. Kargar, B. Debnath, J.-P. Kakko, A. Saÿnätjoki, H. Lipsanen, D.L. Nika, R.K. Lake, A.A. Balandin, Direct Observation of Confined Acoustic Phonon Polarization Branches in Free-Standing Semiconductor Nanowires, Nat. Commun. 7 (2016) 13400. https://doi.org/10.1038/ncomms13400.
[26] F. Kargar, S. Ramirez, B. Debnath, H. Malekpour, R.K. Lake, A.A. Balandin, Acoustic Phonon Spectrum and Thermal Transport in Nanoporous Alumina Arrays, Appl. Phys. Lett. 107 (2015) 171904. https://doi.org/10.1063/1.4934883.
[27] J. Renteria, S. Legedza, R. Salgado, M.P. Balandin, S. Ramirez, M. Saadah, F. Kargar, A.A. Balandin, Magnetically-Functionalized Self-Aligning Graphene Fillers for High-Efficiency Thermal Management Applications, Mater. Des. 88 (2015) 214–221. https://doi.org/10.1016/j.matdes.2015.08.135.
[28] A.A. Balandin, F. Kargar, S. Ramirez, H. Malekpour, Brillouin-Mandelstam Light Scattering Spectroscopy of the Nanoscale Phononic Superlattice Arrays, in: Nonlinear Opt., Optical Society of America, Washington, D.C., 2015: p. NTh3A.4. https://doi.org/10.1364/NLO.2015.NTh3A.4.
[29] Z. Baniamerian, R. Mehdipour, F. Kargar, A Numerical Investigation on Aerodynamic Coefficients of Solar Troughs Considering Terrain Effects and Vortex Shedding, Int. J. Eng. 28 (2015) 940–948. https://doi.org/10.5829/idosi.ije.2015.28.06c.15.

CONFERENCE PRESENTATIONS

1. F. Kargar, E. H. Penilla, C-Y. T. Huang, E. Aytan, J. E. Garay, and A. A. Balandin, “Fine-tuning the acoustic phonon spectrum in bulk crystals via incorporation of the size-dissimilar dopant atoms: Brillouin-Mandelstam

spectroscopy study," in *Materials Research Society* (*MRS) Spring Meeting and Exhibit*, April 2019, Phoenix, Arizona, US.

2. F. Kargar, Z. Barani, S. Naghibi, J. Lewis, C- Y. T. Huang, R. Salgado, and A.A. Balandin, "Graphene Enhanced Thermal Interface Materials for Electronic Heat Removal and Electromagnetic Shielding," in *Thermal Materials Summit*, May 2019, Los Angeles, US.
3. F. Kargar, Z. Barani, J. S. Lewis, R. Salgado, S. Naghibi, E. Aytan, and A.A. Balandin, "Graphene composites for thermal and electromagnetic shielding applications: Performance below and above percolation thresholds," in *Materials Research Society* (*MRS) Spring Meeting and Exhibit*, April 2017, Phoenix, Arizona, US.
4. C-Y. T. Huang, F. Kargar, B. Debnath, T. Debnath, A. Geremw, M. Valentin, L. Bartels, R. Lake, and A. A. Balandin, "Enhanced Light-Matter Interaction in Phononic Superlattices with Fine-Tuned Shape," in *Materials Research Society* (*MRS) Spring Meeting and Exhibit*, April 2017, Phoenix, Arizona, US.
5. F. Kargar, and A. A. Balandin, "Graphene enhanced thermal interface materials for electronic heat removal and electromagnetic shielding," in *Advanced Technology for RF Systems Symposium* supported by BAE Systems Aerospace Company, 2018, Nashua, NH, US. (invited talk)
6. F. Kargar, and A. A. Balandin, "Graphene enhanced thermal interface materials for electronic heat removal," in *20th Anniversary of TechConnect World Innovation Conference and Expo*, 2018, Anaheim, CA, US.
7. F. Kargar, E. Penilla, E. Aytan, J. Lewis, R. Salgado, J. Garay, and A. A. Balandin, "Modification of phonon spectrum and transport properties of materials via substitutional doping observed with the Brillouin-Mandelstam Spectroscopy", in *American Physical Society (APS) Meeting*, 2018, Los Angeles, CA, US.
8. E. Aytan, F. Kargar, J. Li, W. Lin, B. Debnath, R. Lake, C. L. Chien, J. Shi, and A. A. Balandin, "Spin-phonon coupling in thin film NiO: UV and visible Raman spectroscopy investigation," in *American Physical Society (APS) Meeting*, 2018, Los Angeles, CA, US.
9. J. Lewis, F. Kargar, H. H. Fang, M. A. Loi, and A. A. Balandin, "Raman temperature coefficients and thermal conductivity of methylammonium lead bromide perovskite materials," in *American Physical Society (APS) Meeting*, 2018, Los Angeles, CA, US.
10. F. Kargar, B. Debnath, J.-P. Kakko, A. Säynätjoki, D. L. Nika, R. K. Lake, and A. A. Balandin, "Direct observation of confined acoustic phonon branches in individual free-standing semiconductor nanowires," in *Materials Research Society* (*MRS) Spring Meeting and Exhibit*, 2017, Phoenix, Arizona, US.
11. E. Aytan, M. M. Lacerda, R. Samnakay, J. Li, B. Debnath, S. Su, R. Lake, J. Shi, F. Kargar, and A. A Balandin, "Resonant and non-resonant Raman spectroscopy of nickel oxide crystals and thin films," in *Materials Research Society* (*MRS) Spring Meeting and Exhibit*, 2017, Phoenix, Arizona, US.
12. F. Kargar, B. Debnath, J.-P. Kakko, A. Säynätjoki, D. L. Nika, R. K. Lake, and A. A. Balandin, "Observation of acoustic phonon confinement effects in arrays of semiconductor nanowires using Brillouin-Mandelstam spectroscopy," in *ASME's International Mechanical Engineering Congress & Exposition (IMECE)*, 2016, Phoenix, Arizona, US.
13. A. A. Balandin, F. Kargar, S. Ramirez, and H. Malekpour, "Brillouin-Mandelstam light scattering spectroscopy of the nanoscale phononic superlattice arrays," in *Nonlinear Optics*, 2015, Kauai, Hawaii, US.
14. F. Kargar, G. Liu, and A. A. Balandin, "Brillouin-Mandelstam light scattering spectroscopy of acoustic phonons in nanoporous alumina periodic arrays," in *Materials Research Society* (*MRS) Fall Meeting and Exhibit*, 2015, Boston, Massachusetts, US.
15. F. Kargar, R. Salgado, S. Legedza, J. Renteria, and A. A. Balandin, "A comparative study of the thermal interface materials with graphene and boron nitride fillers," in *Proc. of SPIE the International Society for Optics and Photonics*, vol. 9168. p. 91680S–91680S–5, 2014, San Diego, CA, US.
16. S. Legedza, F. Kargar, R. Salgado, M. P. Balandin, S. Ramirez, J. Renteria, and A. A. Balandin, "Graphene applications in thermal interface materials for heat removal from advanced electronics," in *Graphene Week* 2014, Gothenburg, Sweden.
17. P. S. Izadkhast, F. Kargar, and S. Z. Haratbar, "Experimental performance analysis of a prototype solar desiccant air-conditioning system installed at hot and humid region of Persian Gulf," in *International Conference on Applied Energy (ICAE)*, 2012, Sozhou, China.
18. F. Kargar, and P. S. Izadkhast, "Design and optimization of dish/Stirling engine system concentrators," in *Proc. of 26th International Power System Conference*, 2011, Tehran, Iran.

PROFESSIONAL ACTIVITIES

- Active Reviewer: Reviewed over 50 papers for *Applied Physics Letters (APL), Journal of Applied Physics (JAP), Scientific Reports–Nature, ACS Applied Materials & Interfaces, Polymers, Journal of Composite Science and Technology, Fuel Cells, Journal of Magnetism and Materials, The Canadian Journal of Chemistry.*
- Editorial Board Member of Journal of Composite Science
- Member, Material Research Society (2015 – present)

GRANTS AND AWARDS

- Dean's Distinguished Fellowship, University of California, Riverside (*Sep 2013-June 2014)*
- Among the 15 top reviewers of Applied Physics Letters in 2018.