Ken Araki

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Summary

Ph.D. in Mechanical Engineering with theoretical and experimental background in heat transfer, and with hands-on experience in laboratory experiments, outdoor thin film testing, optical, electrical, thermal properties characterization of thin film coatings. Address challenges in thermal systems by applying fundamental heat transfer models. Hands-on experience on design and execution of thermal experiment using vacuum chamber, vacuum pump, digital multimeter, and thermal sensors. 7 first author peer-reviewed scientific publication in fields of heat transfer, optics, and materials science.

Work Experience

Experimental Thermal Radiation Postdoctoral Researcher Jan. 2019 – Present
Arizona State University Tempe, AZ

- Spearheaded continuous power generation in a vacuum chamber with self-adaptive vanadium dioxide (VO_2) coating integrated on a thermoelectric generator (TEG); validated the hot side temperature and heat flux through the system against a heat transfer model
- Instituted an infrared camera to measure temperature of the thin film coating that is exposed to sun during daytime and space during nighttime, thereby eliminating potential heat losses or gains associated with thermocouple or thermistor wires; reduced parasitic heat loss from 10% to 1%.
- Investigated the growth mechanisms of VO_2 thin films and multilayers through various advanced deposition technologies, including sputtering, furnace oxidation, and rapid thermal process (RTP), achieving an enhancement in infrared transmittance contrast from 23% to 46%.

Theoretical Thermal Radiation Postdoctoral Researcher Dec. 2023 – Aug. 2024
University of North Texas Remote

- Refined resonant grating geometric parameters using Bayesian optimization and Neural Network, successfully minimizing infrared emissivity to 0.02 so that it functions as super mirror.

Teaching Assistant of Thermodynamics and Heat Transfer Aug. 2021 – Dec. 2021
University of North Texas Denton, TX

- Facilitated recitations and assessed student performance by grading homework, exams and quizzes for thermodynamics (Fall 2021) and heat transfer (Spring 2022, Fall 2022) courses.

Graduate Research on Thermal Radiation and Optics Aug. 2019-Dec. 2021
University of North Texas Denton, TX

- Executed comprehensive optical characterization using Variable Angle Spectroscopic Ellipsometry (VASE) while leading collaborative projects with Department of Chemistry
- Enhanced the performance of VO_2-based self-adaptive radiative coolers through rigorous coupled-wave analysis (RCWA), finite difference time domain (FDTD) simulations, and Bayesian optimization, boosting emissivity contrast to 0.73.

Undergraduate Research on Thermal Radiation and Optics Apr. 2018-Mar. 2019
Niigata University Niigata, Japan

- Optimized infrared emissive coatings, utilizing transfer matrix method (TMM) and RCWA programmed in MATLAB, Python and C++.

High School Research on Thermal Conduction and Convection Apr. 2016 – Mar. 2017

National Institute of Technology, Gunma College — Maebashi, Japan

- Conducted thermal analysis on the effects of grinding speed on work hardening of austenitic stainless-steel employing SOLIDWORKS simulation (Finite Element Analysis) to optimize process parameters and prevent the phase transition from austenitic to martensite structures.

Education

University of North Texas — Denton, TX
Ph.D. in Mechanical Engineering — Aug. 2019 – Dec. 2021

Niigata University — Niigata, Japan
B.S. in Mechanical Engineering — Apr. 2017 – Mar. 2019

National Institute of Technology, Gunma College — Maebashi, Japan
Mechanical Engineering (Associate) — Apr. 2012 – Mar. 2017

- Completed five-year combined high school and college

Publication

- K. Araki, V. K. Rajan, & L. Wang, Tunable Coatings on Various Substrates for Self-Adaptive Energy Harvesting and Nighttime Radiative Cooling (submitted)
- V. K. Rajan, K. Araki, R. Y. Wang & L. Wang, Thermal Radiative Properties of Tungsten – doped Vanadium Dioxide Thin Films Fabricated in an Extremely Low – oxygen Furnace Environment, International Journal of Thermophysics (accepted)
- K. Araki, V. K. Rajan & L. Wang, Maximizing Infrared Transmission Contrast upon Phase Transition of Thermally Grown Vanadium Dioxide Thin Films by Rapid Thermal Processing, ACS Applied Electronic Materials, 7, 9754-9764 (2025)
- K. Araki & R. Z. Zhang, Resonant-mode metasurface thermal super mirror by deep learning-assisted optimization algorithms, Journal of Quantitative Spectroscopy and Radiative Transfer, 329, 109195 (2024)
- K. Araki & R. Z. Zhang, Infrared radiative switching with thermally and electrically tunable transition metal oxides-based plasmonic grating, Scientific Reports, 13(1), 3702 (2023)
- R. Z. Zhang & K. Araki, Ultralow emittance thermal barrier achieved by a high-contrast grating coating, Journal of Thermophysics and Heat Transfer 37(1), 227-239 (2023)
- K. Araki & R. Z. Zhang, An optimized self-adaptive thermal radiation turn-down coating with vanadium dioxide nanowire array, International Journal of Heat and Mass Transfer, 191, 122835 (2022)
- K. Araki & R. Z. Zhang, Simultaneous solar rejection and infrared emission switching using an integrated dielectric-on-VO_2 metasurface, AIP Advances, 12(5) (2022)
- K. Araki & R. Z. Zhang, Mechano-optical resonant emission by edge angle modulation of wrinkled graphene on plasmonic metal gratings, ACS Applied Nano Materials. 4(8), 8399-8407 (2021)
- K. Araki & R. Z. Zhang, Plasmon-resonance tailoring of “origami” graphene-covered photonic gratings, Optics Express, 28(15), 22791-22802 (2020)

Conferences & Presentations

- K. Araki & L. Wang, All-Day Thermophotonic Solid-State Power Generation with Self-Switchable

Thermochromic Coating, ASME International Mechanical Engineering Congress and Exposition (IMECE), Oral Presentation, Portland OR, Nov. 17 – 21, 2024.

- K. Araki & L. Wang, Design, Fabrication and Characterization of Self-Switchable Thermochromic Coating for All-Day Thermophotonic Power Generation, ASME International Mechanical Engineering Congress and Exposition (IMECE), Poster Presentation, Portland OR, Nov. 17 – 21, 2024.
- K. Araki & R. Z. Zhang, Resonant-Mode Metasurface Thermal Super Mirror Assisted by Machine Learning, The International Workshop on Nano-Micro Thermal Radiation (NanoRad), Sapporo Hokkaido, Japan, Jul. 17 – 19, 2023.
- K. Araki, F. Anwar, S. Alhowity, O. Omolere, L. Wang, J. A. Kelber & R. Z. Zhang, Epitaxial growth of vanadium dioxide for thermochromic coatings, Asian Thermophysical Properties Conference (ATPC), Virtual Conference, Sept. 26 – 30, 2022.
- K. Araki & R. Z. Zhang, Mid-infrared transparent solar reflector using high-index material for thermochromic and thermo-radiative cooling metasruface, Metamaterials, Photonic Crystals and Plasmonics Conference (META), Torremolinos, Spain, Jul. 19 – 22, 2022.
- K. Araki & R. Z. Zhang, Self-Thermal Regulating VO_2-Fabry-Perot Cavity Coating for Passive Radiative Cooling Device, ASME Summer Heat Transfer Conference (SHTC), Philadelphia PA, Jul. 1, 2022
- K. Araki & R. Z. Zhang, Tailoring optical properties of "origami" graphene covered photonic grating, IEEE Photonics Virtual Conference, Oct. 19, 2021.
- K. Araki & M. Kurose, The Effect of Grinding Speed on Work Hardening of Austenitic Stainless Steel, 56th Graduating Research Conference, Japan Society of Mechanical Engineers, Tokyo, Japan, Mar. 16, 2017.

Skills

- Thermal testing and validation
- Finite element analysis
- Thermal sensors (thermocouple, thermistor, infrared camera)
- Data acquisition (digital multimeter, source meter)
- Characterization (FTIR, Ellipsometry, Four-Point Probes, Profilometer)
- Process engineering (sputtering, e-beam evaporation, PECVD, ALD, RTP, furnace)
- Optical engineering (TMM, RCWA, FDTD)
- Problem solving
- Teamwork
- Data analysis
- Experimental design and execution
- Writing & editing
- Public speaking & presentation