

VINCENT MICHAEL WHEELER

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EXPERIENCE

Assistant Professor

University of Wisconsin–Stout, Dept. of Engineering and Technology, Fall 2018–Present

Convener and Lecturer

Australian National University, Research School of Engineering Spring 2016–Summer 2018

Research Fellow

Australian National University, Solar Thermal Group Winter 2015–Summer 2018

Postdoctoral Researcher

National Renewable Energy Laboratory, Computational Science Center Fall 2014–Winter 2015

Fulbright Fellow

US–Norway Fulbright Foundation, Norwegian University of Science and Tech Summer 2013–Summer 2014

Graduate Research Assistant

University of MN–Twin Cities, Department of Mechanical Engineering Fall 2009–Summer 2013

Teaching Assistant

University of MN–Twin Cities, Department of Mechanical Engineering Spring 2010–Summer 2013

Summer Research Intern

Minnesota Supercomputing Institute Summer 2008

Teaching Assistant / Tutor

St. John's University, Department of Mathematics Spring 2007–Spring 2009

EDUCATION

Doctor of Philosophy, Mechanical Engineering

University of Minnesota–Twin Cities Fall 2009–Summer 2014

Thesis Title: Bridging Scales in Modeling and Simulation of Thermal Transport Processes

Co-advisor: Dr. Kumar K. Tamma · +1 612 743 6415 · ktamma@umn.edu

Co-advisor: Dr. Wojciech Lipiński · +61 2 612 57896 · wojciech.lipinski@anu.edu.au

Master of Science, Mechanical Engineering

University of Minnesota–Twin Cities Fall 2009–Summer 2012

Bachelor of Arts, Mathematics

Saint John's University (Collegeville, MN)

Magna cum laude

Fall 2006–Spring 2009

STUDENT SUPERVISION

PhD

- Marziyeh Hamidi—Kinetics of solid-gas cyclic reduction-oxidation heterogeneous reactions for high-temperature thermochemical energy storage
- Sha Li—Thermal modelling and design of a solar reactor for fuel production via metal-oxide based redox cycling
- Bo Wang—Modeling and design of a thermochemical reactor using a fluidized bed for solar energy storage

Undergraduate Theses

- Juntao Sun—Numerical solution to the classical Boltzmann transport equation for modelling high-temperature fluid flow at sub-continuum scales
- Nicholas Adams—Radiative characterisation of small heterogeneous particles
- Luke Magyar—Development of new redox materials for thermochemical energy storage
- Jacob Debono—Effect of brake duct blockers on down force in racecar design (industry partner: Wilkinshaw Racing)

AWARDED PROPOSALS

"A benchtop build-and-test approach for teaching conservation laws through experimentation"

Cervenka Summer Fellowship, University of Wisconsin–Stout Dept. of Engineering and Technology, April 2019

"Plasmon-Driven Solar Thermochemical Water-Splitting by Direct Illumination of Core-Shell Nanoparticles"

Lab Directed Research & Development (LDRD), National Renewable Energy Laboratory, July 2016

"Conservation Laws and the Lattice Boltzmann Method"

Fulbright US Student Program, US–Norway Fulbright Foundation August 2013

TEACHING EXPERIENCE

University of Wisconsin–Stout

Course Instructor

- ENGR-391 Fluid Mechanics (4 semesters)
- ME-495 Advanced Thermal Systems (1 semester)
- ME-405 Capstone I (1 semester)
- ME-352 Introduction to Numerical Methods for Engineers (1 semester)

The Australian National University

Course Convener and Lecturer

- ENGN-3224 Fluid Mechanics and Heat Transfer (1 semester)

Lecturer

- ENGN 3224 Fluid Mechanics and Heat Transfer (1 semester)
- ENGN 2222 Engineering Thermodynamics (2 semesters)

University of Minnesota–Twin Cities

Teaching Assistant

- ME 3331 Thermodynamics (7 semesters)
- ME 5241 Computer-Aided Engineering (3 semesters)
- ME 3333 Heat Transfer (1 semester)
- ME 3224 Introduction to Thermal Science (1 semester)

LEADERSHIP & SERVICE

Manuscript reviewer:

- Solar Energy
- Journal of Quantitative Spectroscopy and Radiative Transfer (Outstanding Reviewer Award, 2017)
- ASME Journal of Solar Energy Engineering
- ASME Journal of Heat Transfer
- Scientific Reports
- Journal of Applied Physics
- International Journal of Thermal Sciences

Search committee member:

- Tenure-track faculty member of the mechanical engineering program in UW–Stout's Department of Engineering and Technology, 2019
- Level B academic position in the Australian National University's Research School of Physics and Engineering, 2016

Faculty Advisor—Engineers Without Borders, UW–Stout Chapter, 2019–present

At-large member—UW–Stout Energy Committee, 2018–present

Organizer—ANU's Solar Thermal Group Forum, 2017–2018

Graduate Student Liaison—Department of Mechanical Engineering, University of Minnesota–Twin Cities, 2010–2011

HONORS & AWARDS

Cervenka Summer Fellowship, 2019

Fulbright Fellowship to Norway, 2013–2014

Chester E. Dekko Departmental Fellowship in Mechanical Engineering, 2009

Magna cum laude, St. John's University, 2009

St. John's University President's Scholarship, 2006–2009

Captain, varsity ice hockey, 2008–09

Minnesota Intercollegiate Athletic Association Academic All-Conference 2006, 2007, 2008

PUBLICATIONS - PEER-REVIEWED JOURNALS¹

- [1] M. Hamidi, V.M. Wheeler*, X. Gao, J. Pye, K. Catchpole, A. Weimer, Reduction of iron–manganese oxide particles in a lab-scale packed-bed reactor for thermochemical energy storage, *Chemical Engineering Science*, 221 (2020) 115700. <https://doi.org/10.1016/j.ces.2020.115700>
- [2] S. Li, V.M. Wheeler, Apurv Kumar, Wojciech Lipiński, Numerical modelling of ceria undergoing reduction in a particle–gas counter-flow: effects of chemical kinetics under isothermal conditions, *Chemical Engineering Science*, 218 (2020) 115553. <https://doi.org/10.1016/j.ces.2020.115553>
- [3] B. Wang, L. Li, J. Pottas, P.B. Kreider, V.M. Wheeler, W. Lipiński, Thermal model of a solar thermochemical reactor for metal oxide reduction, *Journal of Solar Energy Engineering*, 142 (2020) 051002. <https://doi.org/10.1115/1.4046229>
- [4] L.M. Wheeler and V.M. Wheeler, Detailed Balance Analysis of Photovoltaic Windows, *ACS Energy Letters*, 4 (2019) 2130–2136. <https://doi.org/10.1021/acsenerylett.9b01316>
- [5] M. Hamidi, V.M. Wheeler*, P.B. Kreider, K. Catchpole, A.W. Weimer, Effective thermal conductivity of a bed packed with granular iron–manganese oxide for thermochemical energy storage, *Chemical Engineering Science*, 207 (2019) 490–494. <https://doi.org/10.1016/j.ces.2019.06.035>
- [6] M. Hamidi, A. Bayon, V.M. Wheeler, A.W. Weimer, P.B. Kreider., Reduction kinetics for large spherical 2:1 iron–manganese oxide redox materials for thermochemical energy storage, *Chemical Engineering Science*, 201 (2019) 74–81. <https://doi.org/10.1016/j.ces.2019.02.012>
- [7] S. Li, P. B. Kreider, V. M. Wheeler, and W. Lipiński., Thermodynamic Analyses of Fuel Production Via Solar-Driven Ceria-Based Nonstoichiometric Redox Cycling: A Case Study of the Isothermal Membrane Reactor System, *Journal of Solar Energy Engineering*, 141 (2019), 021012. <https://doi.org/10.1115/1.4042228>
- [8] P. L. King, V. M. Wheeler, C. J. Renggli, A. B. Palm, S. A. Wilson, A. L. Harrison, B. Morgan, H. Nekvasil, U. Troitzsch, T. Mernagh, L. Yue, A. Bayon, N. J. DiFrancesco, R. Baile, P.B. Kreider, W. Lipiński, Gas–solid reactions: Theory, experiments and case studies relevant to earth and planetary processes, *Reviews in Mineralogy and Geochemistry*, 84 (2018), 1–56. <https://doi.org/10.2138/rmg.2018.84.1>
- [9] S. Li, V.M Wheeler, P.B. Kreider, R. Bader, W. Lipiński, Thermodynamic Analyses of Solar Hydrogen Production Via Non-Stoichiometric Redox Cycles Part I: Modelling Sweep Gas and Oxidizer Demand, *Energy & Fuels*, 32 (2018) 10838–10847. <https://doi.org/10.1021/acs.energyfuels.8b02081>
- [10] S. Li, V.M Wheeler, P.B. Kreider, R. Bader, W. Lipiński, Thermodynamic Analyses of Solar Hydrogen Production Via Non-Stoichiometric Redox Cycles Part II: Case Study of Doped Ceria, *Energy & Fuels*, 32(2018) 10848–10863. <https://doi.org/10.1021/acs.energyfuels.8b02082>
- [11] V.M. Wheeler, J. Zapata, P.B. Kreider, W. Lipiński, Effect of non-stoichiometry on optical, radiative, and thermal characteristics of ceria undergoing reduction, *Optics Express*, 26 (2018) A360–A373. <https://doi.org/10.1364/OE.26.00A360>
- [12] V.M. Wheeler, R. Bader, P.B. Kreider, M. Hangi, S. Haussener, W. Lipiński, Modelling of solar thermochemical reaction systems, *Solar Energy*, 156 (2017) 149-168. <https://doi.org/10.1016/j.solener.2017.07.069>
- [13] V.M. Wheeler and K.K. Tamma, An overview of phonon-based heat conduction models and their solution, *International Journal of Numerical Methods for Heat & Fluid Flow*, 26 (2016) 916–949. <https://doi.org/10.1108/HFF-10-2015-0427>
- [14] C. Zhang, N. Waksanski, V.M. Wheeler, E. Pan, R. E. Larsen, The effect of photodegradation on effective properties of polymeric thin films: A micromechanical homogenization approach, *International Journal*

¹* denotes corresponding author

of Engineering Science, 94 (2015) 1–22. <https://doi.org/10.1016/j.ijengsci.2015.04.006>

[15] V.M. Wheeler, J. Randrianalisoa, W. Lipiński, K.K. Tamma, Spectral radiative properties of three dimensionally macroscopically-ordered ceria particles, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 143 (2014) 63-72. <https://doi.org/10.1016/j.jqsrt.2013.08.007>

[16] V.M. Wheeler, S.U. Masuri, X. Zhou, K.K. Tamma, M. Sellier, On the applicability of an isochronous integration framework for parabolic/hyperbolic heat conduction problems, *Numerical Heat Transfer Part B: Applications*, 62 (5) (2013) 372-392. <https://doi.org/10.1080/10407782.2012.703462>

PUBLICATIONS - BOOK CONTRIBUTIONS

[17] V.M. Wheeler, N. Shankar, K.K. Tamma, Equation of phonon radiative transport: formulation and analysis by the weighted residual method, *Encyclopedia of Thermal Stresses*, 3 (2013) 1317-1326. <https://doi.org/10.1007/978-94-007-2739-7>

[18] V.M. Wheeler, K.K. Tamma, The C- and F-processes model: a generalized approach to solving transient diffusive, wavelike and ballistic solid state heat conduction problems, *Encyclopedia of Thermal Stresses*, 2 (2013) 525-536. <https://doi.org/10.1007/978-94-007-2739-7>

[19] V.M. Wheeler, K.K. Tamma, The ballistic-diffusive approximation: a new look, *Encyclopedia of Thermal Stresses*, 1 (2013) 345-345. <https://doi.org/10.1007/978-94-007-2739-7>

PUBLICATIONS - CONFERENCE PAPERS

[20] M. Hangi, V.M. Wheeler, and W. Lipiński, Numerical Investigation of Heat and Mass Transfer in a Structured Packed Bed of Porous Spherical Particles, *International Heat Transfer Conference 16*, January 2018. <https://doi.org/10.1615/IHTC16.pma.022800>

[21] B. Wang, V.M. Wheeler, J. Pottas, P.B. Kreider, and W. Lipiński, Thermal Modelling of a Solar Thermochemical Reactor for Metal Oxide Reduction, *International Heat Transfer Conference 16*, January 2018. <https://doi.org/10.1615/IHTC16.nee.022948>

[22] V.M. Wheeler, J. Zapata, P.B. Kreider, and W. Lipiński, Effect of Non-Stoichiometry on Optical Properties and Thermal Behavior of Ceria Particles Under Concentrated Solar Irradiation, *Eurotherm Seminar 110—Computational Thermal Radiation in Participating Media, VI*, April 2018.

[23] V.M. Wheeler, J.I. Zapata, P.B. Kreider, W. Lipiński, Radiative Properties of Non-Stoichiometrically Reduced Ceria, *Light, Energy and the Environment, OSA Technical Digest*, (2017) Paper RTh2B.6. <https://doi.org/10.1364/OSE.2017.RTh2B.6>

[24] L.D. Yue, V.M. Wheeler, W. Lipiński, Combined heat transfer in a directly irradiated optically-large heterogeneous spherical particle, *Proceedings of the 8th International Symposium on Radiative Transfer*, (2016) Paper RAD-16-NH6. <http://abstract.ichmt.org/RAD-16/RAD-16-NH6.pdf>

[25] V.M. Wheeler, J. Randrianalisoa, W. Lipiński, and K.K. Tamma, Spectral radiative properties of three dimensionally macroscopically-ordered ceria particles, *Proceedings of the 7th International Symposium on Radiative Transfer*, (2013) 143–157. <http://dx.doi.org/10.1615/ICHMT.2013.IntSympRadTransf.120>

[26] J.C. McLane, W.W. Czech, D.A. Yuen, M.R. Knox, J.B.S.G. Greensky, M.C. Kameyama, V.M. Wheeler, R. Panday, and H. Senshu, Ubiquitous interactive visualization of 3-D mantle convection through web applications using java, *Advances in Visual Computing*, 5359 (2008) 1011-1021. http://dx.doi.org/10.1007/978-3-540-89646-3_101

PUBLICATIONS - IN PREPARATION

[*] M. Hangi, V.M. Wheeler, W. Lipiński, Numerical determination of permeability and Forchheimer coefficient in dual-scale porous media, *International Communications on Heat and Mass Transfer*, in review.

[*] M. Hangi, V.M. Wheeler, W. Lipiński, Convective–conductive heat transfer in a dual-scale porous medium: theoretical model development and numerical validation, *International Journal of Heat and Mass Transfer*, in review.

[*] V.M. Wheeler, P.B. Kreider, L.M. Wheeler, W. Lipiński, Detailed characterization of ceria absorption characteristics at varying levels of non-stoichiometry, *target journal: TBD*, in preparation.

[*] V.M. Wheeler, K.R. Naqvi, Modeling thermal size effects and transients in thin solid films using a moment-matching approximation, *target journal: Applied Physics Letters*, in preparation.

[*] V.M. Wheeler, L.M. Wheeler, R.E. Larsen, Plasmon-Driven Solar Thermochemical Water-Splitting by Direct Illumination of Core-Shell Nanoparticles, *target journal: TBD*, in preparation.

CONFERENCE PRESENTATIONS

[1] AIChE Solar Energy Systems Conference 2019
Oral Presentation: “Detailed Balance Analysis of Photovoltaic Windows”
Waco, Texas, 13 December 2019

[2] 2018 AIChE Annual Meeting
Oral Presentation: “Revisiting Efficiency Limits of Solar Thermochemical Fuel Production By Non-Stoichiometric Ceria-Based Redox Cycling”
Pittsburgh, Pennsylvania, 19 October 2018

[3] Symposium on Thermophysical Properties
Oral Presentation: “Optical Characterization of Non-Stoichiometric Ceria Films”
Boulder, Colorado, 29 June 2018

[4] Asia–Pacific Solar Research Conference
Oral Presentation: “Multi-Scale Design for High Efficiency Thermochemical Fuel Production”
Melbourne, Australia, 6 December 2017

[5] 5th Micro/Nanoscale Heat and Mass Transfer Conference
Oral Presentation: “A Weighted Residual Approach to Lattice-Based Transport Simulation”
Singapore, 6 January 2016

[6] 7th International Symposium on Radiative Transfer
Oral Presentation: “Spectral radiative properties of three-dimensionally ordered macroporous ceria particles”
Kuşadası, Turkey, 4 June 2013

[7] United States National Congress on Computational Mechanics
Oral Presentation: “On the applicability of an isochronous integration framework for parabolic/hyperbolic heat conduction problems”
Minneapolis, Minnesota, 4 June 2011

INVITED PRESENTATIONS

[8] Saint John's University, Department of Physics
"Perspectives on energy use and advances in two emerging solar energy technologies"
31 January 2020,

[9] Weimer Research Group, University of Colorado–Boulder
"Solar fuels via non-stoichiometric ceria: thermodynamic limits and opto-thermal considerations"
27 June 2018,