Dr. Ji-Cheng (JC) Zhao

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Experience:

2019-Present: Department Chair and Clark Distinguished Chair Professor (Minta Martin Professor of Engineering (2019-2023), Department of Materials Science and Engineering, University of Maryland, College Park, MD.

2017-2019: Professor and Associate Chair for Research, Department of Materials Science and Engineering, The Ohio State University, Columbus, OH.

2014-2017: Program Director, US Department of Energy (DOE) Advanced Research Projects Agency–Energy (ARPA-E), Washington, DC (1/2014–8/2017).

2010-2013: Professor, Department of Materials Science and Engineering, The Ohio State University, Columbus, OH.

2008-2010: Associate Professor, Department of Materials Science and Engineering, The Ohio State University, Columbus, OH.

1995-2007: Senior Materials Scientist & Project/Team Leader, GE Research Center, General Electric Company (GE), Niskayuna, NY.

1991-1995: Research Assistant and Teaching Assistant (Ph.D. student), Lehigh University, Bethlehem, PA.

1988-1991: Professor Assistant, Department of Materials Science and Engineering, Central South University, Hunan, China.

Education:

Lehigh University, Bethlehem, PA
Ph.D. in Materials Science and Engineering, October 1995
Central South University, Hunan, China
M.S. in Materials Science and Engineering, June 1988
B.S. in Materials Science and Engineering, June 1985

Research:

- ***Combinatorial/High-Throughput Materials Research and Materials Property Microscopy***
  - Invented a diffusion-multiple approach for accelerated discovery of new materials. The methodology was featured on the front covers of *Advanced Engineering Materials* (March 2001) and *MRS Bulletin* (April 2002), in a "News and Views" item of *Nature* (by R.W. Cahn: https://dx.doi.org/10.1038/35070692), and in a cover story of *Chemical and Engineering News* (August 27, 2001: https://pubs.acs.org/cen/coverstory/7935/7935combinatorial2.html). A news item of *MRS Bulletin* "Research/Researchers" (https://doi.org/10.1557/mrs2001.132, p. 495) stated "Zhao's method provides a significant step forward by allowing simultaneous determination of structural properties such as plastic hardness, toughness, and elastic modulus – critical features in materials science applications."… "This technique may offer significant potential for practical advances … not only would this technique allow faster concept-to-market turnaround in structural materials design, it should also permit more informed "fine-tuning" of complex materials composition."…"This technique may also generate contributions in the realm of fundamental scientific interest. In particular, the rapid, in situ property measures may provide feedback very useful for modeling of complex materials."

- Co-developed (with Prof. David Cahill) a set of ultrafast-laser based micron-resolution materials property microscopy tools for thermal conductivity, coefficient of thermal expansion (CTE), and heat capacity [https://doi.org/10.1038/nmat1114, https://doi.org/10.1063/1.2988111, https://doi.org/10.1063/1.4815867].
- Developed a dual-anneal diffusion-multiple (DADM) approach for high-throughput determination of intermediate-temperature phase diagrams and for effective study of phase precipitation [https://dx.doi.org/10.1016/j.actamat.2014.12.027]. The methodology can be employed to generate amazing diversity of microstructures [https://rdcu.be/b5U3J] for discovery of new alloys and to validate precipitation model predictions.
- Developed a method to measure single-crystal elastic constants from polycrystalline samples using ultrafast laser generated surface acoustic wave velocity measurements. The method will provide easy measurement of elastic constants of solid solutions without making single crystals [http://rdcu.be/ryL6].
- Developed a forward-simulation analysis (FSA) for reliable extraction of both *impurity* (*dilute)* and interdiffusion coefficients from regular diffusion couple concentration profiles [http://doi.org/10.1016/j.intermet.2012.11.012]. Accurate extraction of impurity diffusion coefficients is significant [https://doi.org/10.1016/j.scriptamat.2016.09.040] since it is impractical to rely on the laborious tracer experiments to obtain the thousands of missing impurity diffusion coefficients which are the foundation of reliable diffusion (mobility) databases for simulation of materials processes.
- Developed an elegant liquid-solid diffusion couple (LSDC) design that allows reliable and efficient determination of impurity and interdiffusion coefficients for challenging systems with low eutectic temperatures and/or limited solubility such as Ca diffusion in Mg (no data was ever obtained before) [https://doi.org/10.1016/j.scriptamat.2016.09.008]; and applied both LSDCs and diffusion multiples to obtain the most reliable and comprehensive experimental measurements of diffusion of 10 elements (Al, Ca, Ce, Gd, Li, Mn, Nd, Sn, Y and Zn) in Mg and established the best database in the world (https://doi.org/10.1016/j.actamat.2020.09.079).
- Co-developed (with John Allison) a novel high-throughput method to measure interfacial energy – an essential but difficult to measure parameter for understanding and modeling nucleation and growth of precipitates [https://doi.org/10.1016/j.mtla.2018.10.003].
- Participated at the development (invented by Prof. Liangbing Hu) of a new ultrafast high-temperature sintering (UHS) method that enables synthesis of ceramics and metals in seconds from elemental powders or chemical precursors. The methodology was featured on the **cover** of ***Science*** (May 1, 2020) [https://science.sciencemag.org/content/368/6490] and also featured in 9 news outlets including *Yahoo! News*, *C&EN*, *ScienceDaily*, *EurekaAlert*, *Phys.org*, *Ceramics.org*, *Nanotechnology Now*, and *The Independent*. UHS synthesis is also applicable to a wide range of metals including very high-melting point alloys [https://doi.org/10.1002/advs.202004229] and cermets (ceramic-metal composites) [https://doi.org/10.1016/j.matt.2021.11.008].

- ***Computational Thermodynamics & Kinetics for Design of Advanced Alloys***
- Introduced thermodynamic software (Thermo-Calc) to GE Research in 1996 and spent several years to make it one of the key computational alloy design tools at GE; worked with several organizations to measure phase diagrams and perform thermodynamic modeling to improve thermodynamic databases for Ni-base superalloys and Nb silicide composites.
- Developed a robust 1-parameter-only Z-Z-Z model to mathematically describe diffusion coefficients and atomic mobilities of binary solid solutions [https://doi.org/10.1016/j.actamat.2021.117077] as well as simplified models for ternary and multicomponent systems [https://doi.org/10.1016/j.scriptamat.2021.114227] which will substantially reduce the number of fitting parameters for binary and multicomponent diffusion (mobility) databases for kinetic modeling in materials science.

- Studied composition-structure-property relationships in Ni-based superalloys and Nb silicide in-situ composites under the support of both GE and US Air Force.
- Led several bond-coat development projects at GE Research and developed new coatings.
- Co-invented high-temperature alloy superalloy GTD262 which is now widely used in GE electricity generation gas turbines (both new makes and replacement parts for existing fleets as a complete replacement of a GE workforce alloy GTD222). The computational design of GTD262, which was developed in four years from concept to production, was cited as one of the two successful ICME alloy design examples in a National Research Council report "*Application of Lightweighting Technology to Military Aircraft, Vessels, and Vehicles*" [http://www.nap.edu/read/13277/chapter/7#118; p. 118-119].
- Co-invented technologies leading to 49 issued U.S. patents and 18 additional U.S. patent applications on various new materials, processes and energy storage and conversion systems.
- Co-developed (with Wolfgang Windl) a general model for both thermal and electrical conductivity of metallic systems based on a new and physically correct interpretation of the scattering processes using calculated orbital and element-resolved density-of-states values from DFT and experimental data – the model enables incorporation of thermal and electrical conductivity into the CALPHAD framework [https://doi.org/10.1016/j.actamat.2016.12.047].

- ***Hydrogen Storage Materials and Boron Chemistry***

- Served as leader of the GE hydrogen storage team in developing new hydrogen storage materials and innovative hydrogen and energy storage systems; obtained 6 U.S. patents on hydrogen/energy storage materials and devices.
- Served as one of the US experts in the International Energy Agency (IEA) hydrogen storage Task 17 and Task 22, and as a member of Coordination Council of the DOE Metal Hydride Center of Excellence (MHCoE).
- Co-developed (with Sheldon Shore) new synthesis methods for $Mg(BH_4)_2$, NH_3BH_3, $NH_2B_2H_5$, $[H_2B(NH_3)_2][BH_4]$, NaB_3H_8, $NH_4B_3H_8$, $[H_2B(NH_3)_2][BH_4]$ and several other compounds and examined their suitability for hydrogen storage.
- Revealed (with Sheldon Shore) the dominant role of dihydrogen bonds in the formation of $[H_2B(NH_3)_2][BH_4]$ in the reaction of NH_3 with $THF{\cdot}BH_3$, and solved a mechanistic "puzzle" in boron chemistry [https://doi.org/10.1021/ja203648w; http://doi.org/10.1021/ar400099g].
- Identified (with Chris Wolverton and Sheldon Shore) the structure of AlB_4H_{11}, one of the very rare inorganic amorphous chain polymer compounds through a highly collaborative study combining state-of-the-art computation with careful experimental measurements [https://doi.org/10.1039/C2SC21100A]; synthesized another rare inorganic chain compound $NH_3BH_2NH_2BH_3$ – an inorganic analogue of butane [https://doi.org/10.1021/ja104938v].

ARPA-E Program Creation and Management:

- Initiated and developed a $32 million ($25M regular + $7M SBIR) ARPA-E GENSETS Program (https://arpa-e.energy.gov/?q=arpa-e-programs/gensets) – *GENerators for Small Electrical and Thermal Systems* – to fund the development of transformative generators with kW scale of electrical output, high efficiency, long life, low cost, and low emissions. Such transformative generator technologies will lay the foundation for widespread deployment of residential and commercial combined heat and power (CHP) that provides distributed generation of electricity from piped-in natural gas at a residence or a commercial site complemented by use of exhaust heat for local heating and cooling. If adopted widely by U.S. residential and commercial sectors, GENSETS CHP systems could lead to substantial annual primary energy savings and CO_2 emissions reductions.
- Initiated (together with Ron Faibish and Alex Larzelere) and helped launch (with Rachel Slaybaugh) the ARPA-E MEITNER (Modeling Enhanced Innovations Trailblazing Nuclear Energy Reinvigoration) program to fund innovative designs of advanced nuclear power plants

and computational validation of these designs that can achieve safe, secure, and economical nuclear power production. [https://arpa-e.energy.gov/events/safe-secure-megawatt-size-nuclear-power-workshop; https://www.youtube.com/watch?v=-jERkHhw2Ec; https://arpa-e.energy.gov/technologies/programs/meitner].

- Managed other ARPA-E projects totaling about $30 million such as the REACT (Rare Earth Alternatives in Critical Technologies – initiated by Mark Johnson) permanent magnet projects and other teams and projects under the OPEN programs and the IDEAS program span a wide range of technologies including structural materials, solar materials and manufacturing processes, and magnetocaloric materials.

Awards and Recognitions:

- Named a member of the National Academy of Engineering (NAE), Class of 2023. Citation: *For contributions to computational alloy design, integrated computational materials engineering, and high-throughput methods used in industrial products*. https://mse.umd.edu/news/story/jc-zhao-elected-to-national-academy-of-engineering-nae
- Clark Distinguished Chair Professor (2023-Present): https://eng.umd.edu/news/story/clark-school-names-zhao-chopra-as-clark-distinguished-chairs
- Fellow of TMS (The Minerals, Metals and Materials Society), Class of 2023. Citation: *For contributions to high-throughput research and diffusion studies in metals and early implementation of computational alloy design in turbine industry leading to high-impact alloy deployment*.
- 2023 J. Willard Gibbs Phase Equilibria Award from ASM International. Citation: *For developing highly efficient methods that employ combinatorial principles, and successfully applying them to the determination of phase diagrams, diffusion coefficients, and physical properties in alloy systems*.
- Fellow of the National Academy of Inventors (NAI), Class of 2022 https://today.umd.edu/maryland-engineers-named-to-national-academy-of-inventors
- Fellow of AAAS (American Association for the Advancement of Science), Class of 2022 https://today.umd.edu/seven-faculty-researchers-named-aaas-fellows
- Humboldt Research Award, Alexander von Humboldt Foundation (Stiftung), 2022 https://www.mpie.de/4775573/ji-cheng-zhao-humboldt-award
- 2021 William Hume-Rothery Award from TMS – "*This award is presented annually to recognize a scientific leader for exceptional scholarly contributions to the science of alloys*." A 3-day symposium was held in his honor on March 15-17, 2021 during the 150th TMS Annual Meeting. Citation: *For development of groundbreaking methodologies for systematic measurements of phase-based properties for the understanding of a very large number of alloy systems*.
- Fellow of MRS, Class of 2019. Citation: *For pioneering research on high-throughput measurement in the field of structural materials through the invention and application of the diffusion-multiple approach and co-invention of ultrafast laser materials–property microscopy tools.*
- The invention of ultrafast laser materials property microscopy by the Zhao-Cahill team was recognized as one of the eight finalists for the 2018 *Berthold Leibinger Innovationspreis*, the highest remunerated international prizes dedicated to laser technology innovations [https://optics.org/news/9/7/37].
- Member of the Subcommittee on the Materials Genome Initiative of the White House Office of Science and Technology Policy (OSTP) (2014 to 2017).
- Lumley Interdisciplinary Research Award (with Prof. Sheldon Shore), College of Engineering, The Ohio State University, April, 2013.

- Selected by NAE as one of 30 outstanding young engineers from U.S. with 30 outstanding engineers from China to participate at the 1st China-America Frontiers of Engineering Symposium in Beijing and Changsha, October 17-21, 2009.
- Selected by NAE as one of eighty-two brightest young engineers to attend the NAE 2008 Frontiers of Engineering Symposium, 2008. https://www.naefrontiers.org/16987/Creative-Young-Engineers-Selected-to-Participate-in-NAEs-2008-Frontiers-of-Engineering-Symposium-
- Fellow of ASM International, Class of 2003. Citation: *For development of a new combinatorial approach enabling rapid determination of composition-structure-property relationships in high-temperature structural alloys.*
- Albert W. Hull Award from GE Global Research (the highest individual achievement award at GE Research for a young scientist – one or two per year for the entire Research Center across all disciplines), 2001. Citation: *For his leadership skills in advancing innovative, state-of-the-art development methodologies that aim to decrease cycle time for materials discovery while increasing robustness of the work. He also was recognized for his expertise and leadership regarding the critical nature of coatings and high temperature materials, and for his enormous energy and perseverance in solving real business challenges*.
- Alfred H. Geisler Memorial Award from ASM International (Eastern New York Chapter, https://www.asminternational.org/web/eastern-new-york-chapter/member-recognition), 2001 [Winners include two former university presidents and 9 NAE members].

Professional Services:

a) Editorships:

- Associate Editor, *Journal of Materials Informatics* (2021-Present)
- Associate Editor, *Journal of Phase Equilibria and Diffusion* (Springer) (2002-Present).
- Editorial Board of *Intermetallics* (Elsevier) (2014-Present)
- Advisory Board of *Rare Metals* (Springer) (2012-Present).
- Advisory Board of *Progress in Natural Science: Materials International* (Elsevier) (2011-present).
- Advisory Board of *Advanced Engineering Materials* (Wiley-VCH) (2005-Present).
- Volume Co-Organizer of *MRS Bulletin* 2006 themes. https://doi.org/10.1557/mrs2005.21
- Guest Editor, September 2003 issue of *MRS Bulletin* on Ultrahigh Temperature Materials for Jet Engines (https://doi.org/10.1557/mrs2003.189).
- Guest Editor, April 2002 issue of *MRS Bulletin* on Combinatorial Materials Science (https://doi.org/10.1557/mrs2002.96).

b) Reviewer for:

Nature, Nature Materials, Nature Communications, Scientific Reports, Journal of American Chemical Society, Energy and Environmental Science, npj Computational Materials, Acta Materialia, Materials Today, Scripta Materialia, MRS Bulletin, Materials & Design, Metallurgical and Materials Transactions, Journal of the American Ceramic Society, Journal of Physical Chemistry, Energies, Journal of Solid State Chemistry, Intermetallics, Dalton Transactions, Oxidation of Metals, Advanced Engineering Materials, Journal of Materials Research, Journal of Materials Science, Journal of Electronic Materials, International Journal of Hydrogen Energy, Journal of Alloys and Compounds, International Journal of Materials Research (Zeitschrift für Metallkunde), Integrating Materials and Manufacturing Innovation, Materials Science and Engineering A, Science and Technology of Advanced Materials, Modelling and Simulation in Materials Science and Engineering, Journal of Combinatorial Chemistry, CALPHAD, Materials

Characterization, Surface and Coating Technology, Steel Research International, Journal of Phase Equilibria and Diffusion, and Industrial & Engineering Chemistry Research.

c) Membership in Professional Committees:

- The Government Engagement Working Group of the Engineering Research Visioning Alliance (ERVA) – an NSF-funded partnership that identifies future engineering research directions to impact national research priorities (2021-Present). https://www.ervacommunity.org/working-group/government-engagement/
- MRS Awards Committee (Subcommittee) (2022-Present)
- Board of Trustees of ASM International (2019-2022 term)
- Chair of the ASM Board of Trustees' Digital Task Force (2021-2022)
- Member of the ASM Board of Trustees' Finance Committee (2021-2022)
- Member of the Selection Committee for ASM Awards (2020, 2021)
- Chair (2017-2019) and member (2012-Present) of the ASM Materials Properties Database Committee (MPDC).
- Advisor to JOM (Journal of the Minerals, Metals and Materials Society) from the TMS Advanced Characterization, Testing and Simulation Committee (2009-2010).
- Member of the TMS Alloy Phases Committee, TMS (1998-2008 & 2011-Present).
- Member of the TMS Integrated Computational Materials Engineering (ICME) Committee, TMS (2011-present).
- Member of the TMS Advanced Characterization, Testing and Simulation Committee (2008-2013).
- Member of the MRS Program Development Subcommittee (2008-2011).
- Member of the Coordination Council of the DOE Metal Hydride Center of Excellence (MHCoE) (2008-2010).
- Member of the MRS Industrial Meeting Participation Task Force (2006-2007).
- Member of the U.S. expert representatives on the International Energy Agency (IEA) Task 17 and Task 22 on hydrogen storage (2006-2011).
- Member of the Book Review Board, *MRS Bulletin*, MRS (2003-2008).
- Member of the TMS High Temperature Alloys Committee (2001–Present).
- Member of the ASM Thermodynamics and Phase Equilibria Committee (2000-2006).

Organizer of Professional Conferences:

- Co-Organizer, Symposium on *Thermodynamics and Kinetics of Alloys*, 2023 TMS Annual Meeting, March 19-23, 2023: San Diego, CA.
- Co-Organizer, Symposium on *Materials Design Approaches and Experiences V*, 2020 TMS Annual Meeting, February 23-27, 2020: San Diego, CA.
- Co-Chair (with Peter Gumbsch and Dennis Dimiduk), *Gordon Research Conference on Physical Metallurgy*, 2017: https://www.grc.org/programs.aspx?id=13797.
- Co-Organizer, Symposium on Phase Stability, Diffusion Kinetics, and Their Applications (PSDK-XII), Materials Science & Technology 2017 (MS&T'17), Pittsburgh, October 8-12, 2017 (ACerS, AIST, ASM & TMS).
- Co-Organizer, Symposium on Phase Stability, Diffusion Kinetics, and Their Applications (PSDK-XI), Materials Science & Technology 2016 (MS&T'16), Salt Lake City, October 23-27, 2016 (ACerS, AIST, ASM & TMS).
- Co-Organizer, Symposium on *Materials Design Approaches and Experiences IV*, 2016 TMS Annual Meeting, February 14-18, 2016: Nashville, TN.
- Vice-Chair, Gordon Research Conference on Physical Metallurgy, Biddeford, Maine, July 19-24, 2015.

- Executive Committee Member and Symposium Co-Coordinator, THERMEC 2013 (International Conference on Processing & Manufacturing of Advanced Materials), Las Vegas, December 2-6, 2013 (Co-sponsored by TMS, ASM and 12 other societies).
- Member of the International Scientific Committee of the First Asian Conference on Aluminum Alloys (ACAA-2013), Beijing, China, October 13-17, 2013.
- Lead Organizer of an International Conference on "*Harnessing the Materials Genome: Accelerated Materials Development via Computational and Experimental Tools*", Vail, Colorado (with Mark Asta, Peter Gumbsch and Boyun Huang), September 30 to October 4th, 2012. https://www.eurekalert.org/pub_releases/2012-06/eci-htm062712.php
- Lead Organizer, TMS Symposium on Materials Design Approaches and Experiences III, TMS Annual Meeting, Orlando, FL, March 12-15, 2012.
- Co-Organizer, Joining and Sustaining of Superalloys Symposium at Materials Science and Technology 2011 (MS&T'11), Columbus, OH, October 16-20, 2011.
- Co-Chair (one of four) for the MRS 2009 Fall Meeting with 51 symposia that attracted ~6,200 attendees and about 400 exhibitors. https://doi.org/10.1557/mrs2009.13
- Co-Organizer, Symposium X, MRS Fall 2009 Meeting.
- Co-Organizer, Symposium on High-Density Hydrogen Storage for Automotive Applications: Materials and Methods at the Materials Science and Technology Conference (M&ST'07), September 16-20, 2007 (ACerS, AIST, ASM & TMS).
- Organizing Committee Member, International Symposium of Metal-Hydrogen Systems [MH2006], October 1-6, 2006 in Lahaina, Maui, Hawaii.
- Lead Organizer, Symposium on Hydrogen Storage Technologies at the MRS Fall Meeting 2006.
- Advisory Committee Member, The 1st and 2nd International Conferences on Diffusion in Solids and Liquids (DSL-2005 and DSL-2006), Aveiro, Portugal.
- Co-Organizer, TMS Symposium on *Materials Design Approaches and Experiences II*, 2006 TMS Annual Meeting, March 12-16, 2006, San Antonio, Texas.
- Lead Organizer, TMS symposium on *Materials Design Approaches and Experiences*, 2001 TMS Fall Meeting, November 4-8, 2001, Indianapolis, IN.

Publications:

a) Edited Books and Journal Issues:

1. J.-C. Zhao (editor), *Methods for Phase Diagram Determination*, Elsevier (Amsterdam, 2007), ISBN-13: 978-0-08-044629-5, 511 pp. https://www.sciencedirect.com/science/book/9780080446295
2. J.-C. Zhao, I.M. Robertson and S.-I. Orimo (editors), *Hydrogen Storage Technologies* (Materials Research Society (MRS) Symposium Proceedings 971E), MRS (Warrendale, PA, 2007).
3. J.-C. Zhao, M. Fahrmann and T.M. Pollock (editors), *Materials Design Approaches and Experiences*, TMS (Warrendale, PA, 2001), ISBN: 0-87339-503-4, 396 pp.
4. U. Kattner, C.E. Campbell, Y. Sohn, and J.-C. Zhao (Special issue editors), December 2022 issue of the *Journal of Phase Equilibria and Diffusion* in memory of John E. Morral. https://link.springer.com/journal/11669/volumes-and-issues/43-6
5. J.-C. Zhao, Q. Chen, and Y. Du (Special issue editors), December 2021 issue of the *Journal of Phase Equilibria and Diffusion* in memory of Professor Zhanpeng Jin, December 2021. https://link.springer.com/journal/11669/volumes-and-issues/42-6
6. J.-C. Zhao, Q. Chen, and Y. Du (Special issue editors), October 2018 issue of the *Journal of Phase Equilibria and Diffusion* celebrating the 80th birthday of Professor Zhanpeng Jin, October 2018. https://link.springer.com/journal/11669/volumes-and-issues/39-5

7. M.C. Gao, J.-C. Zhao, and John Morral (Special issue editors): August 2017 special issue of *Journal of Phase Equilibria and Diffusion* on The Thermodynamics and Kinetics of High-Entropy Alloys. https://link.springer.com/journal/11669/volumes-and-issues/38-4
8. J. Simmons and J.-C. Zhao (topic organizers): March issue and July issue of *JOM* on Large Dataset Generation, Integration and Simulation in Materials Science, March and July 2011.
9. J.-C. Zhao, Y. Du, and Q. Chen (Special issue editors), October issue of the *Journal of Phase Equilibria and Diffusion* honoring the 70th birthday of Professor Zhanpeng Jin, October 2009. https://link.springer.com/journal/11669/volumes-and-issues/30-5
10. J.-C. Zhao and J.H. Westbrook (Guest Editors), September 2003 issue of *MRS Bulletin* on Ultrahigh Temperature Materials for Jet Engines. https://link.springer.com/journal/43577/volumes-and-issues/28-9
11. E.J. Amis, X.-D. Xiang, and J.-C. Zhao (Guest Editors), April 2002 issue of *MRS Bulletin* on Combinatorial Materials Science. https://link.springer.com/journal/43577/volumes-and-issues/27-4

b) Book Chapters

12. Gokul Vishwanathan, Julian Sculley, David Tew, and Ji-Cheng Zhao, "A Review of Residential Scale Natural Gas Powered Micro-Combined Heat and Power Engine Systems", Chapter 14 in *Natural Gas Engines*, K.K. Srinivasan, A.K. Agarwal, S.R. Krishnan, and V. Mulone, ed., Springer, 2019, pp. 381-419. https://doi.org/10.1007/978-981-13-3307-1_14
13. J.-C. Zhao, "The Role of Phase Transformation Kinetics in Phase Diagram Determination and Assessment", Chapter 2 in *Methods for Phase Diagram Determination*, J.-C. Zhao, ed., Elsevier (Amsterdam, 2007), p. 22-50.
14. J.-C. Zhao, "Phase Diagram Determination Using Diffusion Multiples", Chapter 7 in *Methods for Phase Diagram Determination*, J.-C. Zhao, ed., Elsevier (Amsterdam, 2007), p. 246-272.
15. J.-C. Zhao and J.H. Westbrook, "Miscellaneous Topics on Phase Diagrams", Chapter 16 in *Methods for Phase Diagram Determination*, J.-C. Zhao, ed., Elsevier (Amsterdam, 2007), p. 483-494.
16. J.-C. Zhao, L.A. Peluso, L.N. Brewer, and M.R. Jackson, "Diffusion Multiples for High Efficiency Alloy Design", Chapter 16 in *High Throughput Analysis: A Tool for Combinatorial Materials Science*, edited by R.A. Potyrailo and E.J. Amis (Kluwer Academic / Plenum Publishers, NY, 2003), p. 349-375.

c) Peer Reviewed Journal Articles

17. Noah Kohlhorst, Kevin Faraone, Roger Miller, Govindarajan Muralidharan, George Ulrich, and Ji-Cheng Zhao, "A Technique for the Quantitative Characterization of Weld Microstructure and Application to Mo Welds", *Metallurgical and Materials Transactions B*, vol. 54, pp. 1434-1448, 2023. https://doi.org/10.1007/s11663-023-02771-y
18. Michael Marshall, Meysam Akbari, Ji-Cheng Zhao, Kevin Hoopes, "Design of an Additively Manufactured Recuperator with 800 °C Inlet Temperature for sCO_2 Power Cycle", *Journal of Engineering for Gas Turbines and Power*, vol. 145, 021012, 2023. https://doi.org/10.1115/1.4055723
19. Wei Zhong and Ji-Cheng Zhao, "Vacancy Wind Factor of Diffusion of 13 Binary Metallic Solid Solutions", *Journal of Phase Equilibria and Diffusion*, vol. 43, pp. 629-633, 2022. https://doi.org/10.1007/s11669-022-01013-z
20. Yaxian Wang, Zhangqi Chen, Wolfgang Windl, and Ji-Cheng Zhao, "Nonlinear Arrhenius Behavior of Self-Diffusion in β-Ti and Mo", *Physical Review Materials*, vol. 6, 063402, 2022. https://doi.org/10.1103/PhysRevMaterials.6.063402

21. Chuangye Wang, Wei Zhong, Ji-Cheng Zhao, "Insights on Phase Formation from Thermodynamic Calculations and Machine Learning of 2436 Experimentally Measured High Entropy Alloys", *Journal of Alloys and Compounds*, vol. 915, 165173, 2022. https://doi.org/10.1016/j.jallcom.2022.165173
22. Girfan Shamsutdinov, Peng Zhao, Sreenivas Bhattiprolu, Ji-Cheng Zhao, and Boris Nadgorny, "Magnetization–Structure–Composition Phase Diagram Mapping in Co-Fe-Ni Alloys using Diffusion Multiples and Scanning Hall Probe Microscopy", *Scientific Reports*, vol. 12, 1957, 2022. https://doi.org/10.1038/s41598-022-05121-1
23. Miao Guo, Qi Dong, Hua Xie, Chengwei Wang, Yunhao Zhao, Xizheng Wang, Wei Zhong, Zhihan Li, Ruiliu Wang, Shuaiming He, Wei Xiong, Ji-Cheng Zhao, Liangbing Hu, "Ultrafast High-Temperature Sintering to Avoid Metal Loss Toward High-Performance and Scalable Cermets", *Matter*, vol. 5, pp. 594-604, 2022. https://doi.org/10.1016/j.matt.2021.11.008
24. Wei Zhong, Ji-Cheng Zhao, "Recommendations for Simplified and Robust Assessments of Atomic Mobilities and Diffusion Coefficients of Ternary and Multicomponent Solid Solutions", *Scripta Materialia*, vol. 207, 114227, 2022. https://doi.org/10.1016/j.scriptamat.2021.114227
25. Wei Zhong, Qiaofu Zhang, Ji-Cheng Zhao, "A Simple Yet General Model of Binary Diffusion Coefficients Emerged from a Comprehensive Assessment of 18 Binary Systems", *Acta Materialia*, vol. 215, 117077, 2021. https://doi.org/10.1016/j.actamat.2021.117077
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