

Wangshu (Wayne) Zheng

Processing-Encoded Metastability For
Damage-Adaptive Structural Materials

※ Website
※ ORCID
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Postdoctoral Fellow
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RESEARCH VISION

Materials researcher investigating how non-equilibrium processing and interfacial constraint create and retain metastable states, and how mechanical and environmental stimuli activate them to accommodate strain, dissipate energy, redistribute stress, and retard damage.

- **Create and retain:** rapid processing, additive manufacturing, and metastable-phase retention
- **Activate and adapt:** transformation plasticity, energy absorption, and damage retardation
- **Resolve mechanisms:** multiscale microscopy, in situ micro-/nano-mechanics, impact and fracture

PROFESSIONAL APPOINTMENTS

Incoming Postdoctoral Research Associate **Nov 2026 (Expected)**
University of Oxford | Department of Materials **Oxford**
Principal Investigator: Prof. David Armstrong
✧ Mechanical testing of solid-state battery materials

Postdoctoral Fellow **Jul 2025 – Present**
Nanyang Technological University | School of Materials Science and Engineering **Singapore**
Principal Investigator: Prof. Chee Lip Gan
✧ Research on metastable ceramics, ultrafast processing and joining, and additively manufactured alloys under mechanical and environmental loading

EDUCATION

Dual PhD, Materials | Honor Program **Sep 2020 – Jun 2025**
Nanyang Technological University & Shanghai Jiao Tong University **Singapore & Shanghai**
Supervisors: Prof. Chee Lip Gan, Prof. Qiang Guo
Honours: Outstanding PhD Thesis (top 1%), Outstanding Graduate (top 5%), National Scholarship for Graduate Students (top 5%), Outstanding T.A., Outstanding Counsellor

BEng, Materials | Hsu Tzuyao Honor Class **Sep 2016 – Jun 2020**
Shanghai Jiao Tong University **Shanghai**
Honours: Outstanding Bachelor's Thesis (top 1%), Outstanding Graduate (top 5%)

Research Exchange, Materials **Jun 2019 – Sep 2019**
University of Oxford **Oxford**
Supervisor: Prof. Nicole Grobert | Honours: Overseas Study Scholarship

SELECTED RESEARCH CONTRIBUTIONS

1. **Constrained ceramic phase switching.** Established reversible martensitic transformation of shape-memory ceramic particles within aluminium and examined the roles of matrix constraint and interfaces. *Nature Communications* 14, 7103, 2023. *First author*
2. **Control of retained metastability.** Showed how ceramic chemistry and aluminium-matrix constraint jointly determine the retained phase state and transformation accessibility. *Acta Materialia* 276, 120118, 2024. *First author*
3. **From local switching to bulk response.** Developed an interpenetrating-phase cermet combining load sharing and transformation with high strength and energy absorption. *Materials Research Letters* 13, 51–59, 2025. *Corresponding author*
4. **Interface-sensitive measurement.** Connected aging-mediated element redistribution at ceramic/metal interfaces with local mechanical response using small-angle neutron scattering, electron microscopy and micromechanical testing. *Acta Materialia* 311, 122074, 2026. *Co-first author*
5. **Extending transformation-enabled reinforcement from ceramics to alloys.** Showed that NiTi fillers combine plastic deformation and stress-induced transformation to sustain strain hardening and improve the deformability of aluminium composites. *Advanced Composites and Hybrid Materials* (2026). *Corresponding author*

PROFESSIONAL MEMBERSHIPS

○ Full Member, Sigma Xi	Jun 2026 – Present
○ Member, Materials Research Society	Sep 2026 – Present
○ Member, American Ceramic Society	Jul 2026 – Present
○ Member, Chinese Society for Composite Materials	Apr 2026 – Present
○ Member, Chinese Materials Research Society (CMRS)	Feb 2026 – Present

DISTINCTIONS & AWARDS

○ Principal Investigator, NSFC PhD Programme	2024–2025
○ Reserve candidate, Newton International Fellowship	2026
○ Doctoral Student Innovation Award, Science and Technology Award of CMRS	2026

FULL PUBLICATIONS

(* - corresponding author; † - contribution equally)

Peer-Reviewed Articles

1. Z. Zhao, L. Zhao*, F. Chen, J. Zhao, **W. Zheng***, Q. Guo*. Strong-yet-deformable interfaces to achieve mechanical robustness in CrCoNi-Al bimetal composites. *Materials Research Letters* (Accepted)
2. Y. Hu, **W. Zheng***, S. Jia, X. Liu, X. Feng, S. Mo, L. Zhao*, Q. Guo*. Deformable and transformable

nitinol alloys enable enhanced strain hardening in aluminum. *Advanced Composites and Hybrid Materials* (Accepted)

3. X. Feng, **W. Zheng***, H. Cao, Q. Ouyang, S. Jia, Z. Zhao, B. Li, L. Zhao*, Q. Guo*. Enhanced plastic deformability of SiCp/Al composites via compatible pre-oxidized silica-rich interlayers. *Advanced Composites and Hybrid Materials* (Accepted)
4. H. Yang, L. Zhao*, Z. Zhao, X. Feng, **W. Zheng***, Q. Guo*. Size-dependent strength-plasticity synergy in crystalline-amorphous nanocomposites. *Scripta Materialia* 287, 117566 (2027)
5. T. Shan, J. Zhang*, L. Sun*, J. Han, X. Liang, **W. Zheng**, Z. Li, Z. Li, C. Liu. Multi-scale computational screening strategy of Ag–oxide reactive air brazing fillers for highly stable YSZ/Crofer 22 H joint in Solid Oxide Fuel Cell. *Corrosion Science* 270, 114066 (2026)
6. **W. Zheng†**, X. Feng†, L. Zhao*, X. Guo, Z. Zhao, B. Li, H. Cao, Y. Ke*, Q. Ouyang, C. L. Gan*, D. Zhang, Q. Guo*. Aging-mediated element redistribution to strengthen and toughen ceramic/metal interfaces. *Acta Materialia* 311, 122074 (2026)
7. Z. Zhao, L. Zhao*, **W. Zheng**, X. Wang, Q. Guo*. Strength-toughness synergy in CrCoNi-Al hierarchical lamellar composites rendered by constituent grain size matching. *Materials & Design* 260, 115190 (2025)
8. B. Liu, **W. Zheng**, Z. Zhang, J. Yang, Y. Yuan, F. Li, J. Liu*, L. Zhao, M. Wen, H. Chen, P. Zhang*, L. Gao. Selectively passivated core-satellite cobalt-iron bimetallic phosphide with optimized *OH adsorption for boosting oxygen evolution reaction. *Chemical Engineering Journal* 522, 167382 (2025)
9. Z. Zhao, L. Zhao*, Y. Liu, **W. Zheng**, Q. Guo*. Strength-ductility synergy in CrCoNi medium entropy alloy-reinforced aluminum matrix composites with heterogeneous laminated structures. *Materials Science and Engineering: A* 935, 148380 (2025)
10. **W. Zheng**, Y. Han, L. Ding, Z. Jia, L. Zhao*, G. Yang, Y. Liu, X. Feng, Y. Ke*, H. Zheng, Q. Guo*. Direct quantification of precipitation behavior in engineering Al-Mg-Si alloy: a study using complementary small angle neutron scattering and transmission electron microscopy. *Next Materials* 8, 100594 (2025).
11. S. Jia, **W. Zheng***, D. W. H. Lock, L. Li, L. Zhao*, C. L. Gan, Q. Guo*. A transforming interpenetrating-phase cermet with high strength and energy absorption efficiency. *Materials Research Letters* 13, 51-59 (2025).
12. Y. Liu, L. Zhao*, Y. Hu, G. Wang, **W. Zheng**, T. Vogel, K. M. Reddy, Y. Ke*, D. Zhang*, Q. Guo*. Multi-functional amorphous/crystalline interfaces rendering strong-and-ductile nano-metallic-glass/aluminum composite. *International Journal of Plasticity* 180, 104077 (2024).
13. **W. Zheng**, L. Zhao*, S. Jia, L. Li, Y. Liu, Y. Han, X. Chen, X. Jin, C. L. Gan*, Q. Guo*. Tuning metastable austenite in a phase-transforming ceramic via matrix constraint. *Acta Materialia* 276, 120118 (2024).
14. **W. Zheng**, L. Li, L. Zhao*, Q. Guo*. Design of shape memory ceramics: principles, strategies and perspectives. *JOM* 76, 3604-3621 (2024).
15. L. Zhao*, **W. Zheng**, Y. Hu, Q. Guo, D. Zhang*. Heterostructured metal matrix composites for structural applications: A review. *Journal of Materials Science* 59, 9768-9801 (2024).
16. L. Zhao†, T. Lee†, S. Zheng, **W. Zheng**, S. Ryu*, D. Zhang*, Q. Guo*. Ultrastrong and Deformable Aluminum-Based Composite Nanolaminates with Transformable Binary Intergranular Films. *Nano Letters* 24, 3843-3850 (2024).
17. **W. Zheng**, Y. Shi, L. Zhao, S. Jia, L. Li, C. L. Gan*, D. Zhang*, Q. Guo*. Realizing reversible phase

transformation of shape memory ceramics constrained in aluminum. *Nature Communications* 14, 7103 (2023).

18. Y. Cao†, S. Liang†, W. Dong, C. Dong, **W. Zheng**, S. Nong*, F. Huang*. Unique Sandwich Structure of Ru@TiO₂: Salicylic Acid Microetching from K₂Ti₂O₅ and High-Performance Electrocatalytic Hydrogen Evolution. *Inorganic Chemistry Frontiers* 10, 3852-3859 (2023).
19. G. Yang, Y. Han, Y. Liu, **W. Zheng**, Y. Ke*, Q. Guo*. Impact of graphene (reduced graphene oxide) incorporation on the aging behavior and mechanical properties of Al-Mg-Si alloy. *Materials Science and Engineering: A* 862, 144455 (2023).
20. Y. Han, G. Yang, **W. Zheng**, Q. Guo*. Impact of the reduced graphene oxide (RGO) on the ageing kinetics of Al-Mg-Si alloy with different grain sizes. *Materialia* 21, 101290 (2022).
21. F. Li, **W. Zheng**, J. Liu*, L. Zhao, D. Janackovic, Y. Qiu, X. Song, P. Zhang*, L. Gao. Enhancing the Long-Term Photoelectrochemical Performance of TiO₂/Si Photocathodes by Coating of Ti-Doped Mesoporous Hematite. *ACS Applied Energy Materials* 4, 7882-7890 (2021).
22. I. Zada†, W. Zhang†*, **W. Zheng**, Y. Zhu, Z. Zhang, J. Zhang, M. Imtiaz, W. Abbas, D. Zhang*. The highly efficient photocatalytic and light harvesting property of Ag-TiO₂ with negative nano-holes structure inspired from cicada wings. *Scientific Reports* 7, 17277 (2017).

Doctoral Dissertation

1. **W. Zheng**. Metastable Aluminum Matrix Composites: Transformation-Induced Mechanical Robustness. In: School of Materials Science and Engineering. *Nanyang Technological University* (2025)

Other manuscripts: under review (5), in progress (9)

Patents: 4 filed, 2 applied

CONFERENCES & TALKS

1. Nov 2026, Boston, MRS Fall Meeting & Exhibition, “Engineering metastable shape-memory ceramics in metals”, *Scheduled Oral Presentation*
2. Sep 2026, Oxford, Research group of Emilio Martínez-Pañeda, University of Oxford, “Can metastability become an engineering variable?”, *Invited Presentation*
3. Sep 2026, Cambridge, Alloys for Additive Manufacturing Symposium (AAMS) 2026, “Harnessing active cooling to strengthen and ductilize additively manufactured nickel-based superalloy”, *Oral Presentation*
4. Apr - May 2026, Barcelona, Neutron Scattering Gordon Research Conference, “Aging-induced element redistribution to strengthen and toughen ceramic/metal interfaces”, *Poster Presentation*
5. Jul 2025, Singapore, Applied Materials & Interfaces Conference (AMIC 2025), “Transforming Ceramics Enable Strong-and-Tough Metals”, *Poster Presentation*
6. Jul 2025, Singapore, 12th International Conference on Materials for Advanced Technologies (ICMAT), “Rapid Stimuli-Induced Metastability Enables Strong-and-Tough Cermets”, *Oral Presentation*
7. Jun 2025, Singapore, 12th ICMAT, “Leveraging Element Redistribution to Strengthen and Toughen Ceramic-Metal Interfaces”, *Poster Presentation*
8. May 2025, Paris, 6th International Conference on Materials Science, Engineering & Technology,

“Transforming Fillers Enable Strong-and-Tough Metals”, *Invited Presentation*

9. Dec 2024, Chongqing, 2nd International Conference on Heterostructured Materials, "Design of heterostructured cermets towards high strength and energy dissipation capacity", *Oral Presentation*
10. Oct 2024, Guangdong, 2024 National Conference on Electron Microscopy, "Probing reversible phase transformation of shape memory ceramics under constraint", *Poster Presentation*
11. Jul 2024, Guangdong, The Chinese Materials Conference 2024 (CMC 2024), "Strengthening and Toughening Metal Matrix Composites via Transformation Engineering", *Invited Presentation*

MENTORSHIP

Thesis Mentor **Aug 2026 – Present**

NTU, School of Materials Science and Engineering Singapore
✧ URECA's thesis (2), co-supervised with Prof. Chee Lip Gan

Research Mentor **Dec 2025 – Aug 2026**

Harvard Undergraduate Association for U.S. Cross-Cultural Relations Cambridge, MA (Virtual)
Young Scholars Academic (YSA)
✧ Designed and delivered interdisciplinary research seminars connecting materials science, phase-transition theory, engineering history, and emerging technologies.
✧ Mentored students in research-question formulation, literature analysis, project design, scientific reasoning, and academic communication.

Thesis Mentor **Dec 2021 – Jun 2025**

SJTU, School of Materials Science and Engineering Shanghai
✧ Master's thesis (2); FYP theses (5); UG Project (10+), co-supervised with Prof. Qiang Guo

TEACHING

Teaching Assistant, Interface of Composites **Fall 2022 & Fall 2023**

SJTU, School of Materials Science and Engineering Shanghai

Teaching Assistant, Fundamentals of Materials Science **Fall 2021**

SJTU, School of Materials Science and Engineering Shanghai

Seminar Leader **Aug 2021 – Aug 2023**

Harvard Undergraduate Association for U.S. Cross-Cultural Relations Cambridge, MA (Virtual)
[Harvard Summit for Young Leaders in China \(HSYLC\)](#)
✧ Delivered a six-hour seminar titled "How Can Materials Redefine the 21st Century?"
✧ Reached more than 1,000 high-school students

SERVICE

Peer Review

- Nature Communications, Journal of Applied Physics, Journal of Materials Science, Journal of Materials Research

- Beamtime Proposal, China Spallation Neutron Source (CSNS), 2026

Academic Service & Leadership

- Composite Materials Research Institute, SJTU Shanghai
Manager, Electron Microscopy Group Sep 2020 – Jul 2024
- School of Materials Science and Engineering, SJTU Shanghai
Counsellor Nov 2019 – Jul 2024
Editor-in-chief, New Media Official Team May 2018 – Oct 2019
President, Student Union Oct 2017 – Sep 2019
- Hangzhou Longcan Liquid Metal Technology Co., Ltd. Zhejiang
Project Leader Mar 2018 – Jun 2018

Science Communication & Outreach

- CTB National Youth Research & Innovation Conference Shanghai
Judge Mar 2023 & 2024 & 2026
- TED×Youth, “Life is more than 0 and 1” Shanghai
Invited Speaker 19 Mar 2023

SKILLS

- **Language:** Chinese (Native), English (Professional), German (Basic), Japanese (Basic)
- **Software:** MATLAB, Graphic Design (Adobe Premiere Pro & Photoshop), OriginLab Pro, GSAS, Jade, SasView, and other software associated with the characterisation technologies
- **Processing:** Powder Metallurgy (P&M), Ultrafast high-temperature sintering (UHS), Ceramic/Metal Joining, Stir/Freeze Casting, Pressure/Pressureless Infiltration, Electroless Plating, Hot Extrusion, Hot Rolling, Sol-Gel, Gel-Casting, Additive Manufacturing (Ceramics/Metals)
- **Characterisation:** Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Precession Electron Diffraction (PED), Focus Ion Beam (FIB), X-ray Microscopy (XRM), X-ray/Neutron Diffraction, Small-Angle Scattering (SAS), Raman Microscopy
- **Mechanics:** Uniaxial Tensile/Compression/Bending Tests, Nano-indenter, *In situ* Micro-/Nano-mechanics, Split Hopkinson Pressure Bar (SHPB), Digital Image Correlation (DIC); Failure Analysis