

WANGSHU ZHENG | PhD

Processing-Encoded Metastability For
Damage-Adaptive Structural Materials

✂ Website ✂ LinkedIn

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Postdoctoral Fellow

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RESEARCH VISION

Materials scientist 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 thermal processing, additive manufacturing, interfacial reactions, matrix constraint, and metastable-phase retention
- **Activate and adapt:** martensitic transformation, transformation plasticity, stress redistribution, energy absorption, and damage retardation
- **Resolve mechanisms:** multiscale microscopy, diffraction and scattering, in situ micro-/nano-mechanics, impact and fracture testing

EDUCATION

Dual PhD, Materials | Zhiyuan 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 of Shanghai (top 5%)

BEng, Materials | Hsu Tzuyao Honor Class

Sep 2016 – Jun 2020

Shanghai Jiao Tong University

Shanghai

Honours: Outstanding Bachelor's Thesis (top 1%), Outstanding Graduate of Shanghai (top 5%)

Research Exchange Student, Materials Science

Jun 2019 – Sep 2019

University of Oxford

Oxford

Supervisor: Prof. Nicole Grobert | Honours: Overseas Study Scholarship

PROFESSIONAL APPOINTMENTS

Postdoctoral Fellow

Jul 2025 – Present

Nanyang Technological University | School of Materials Science and Engineering

Singapore

Principal Investigator: Prof. Chee Lip Gan

- ✧ Developing high-reliability structural and multifunctional materials through metastability engineering, non-equilibrium processing, and interface design
- ✧ Current research spans ultrafast-processed ceramics and additively manufactured Ni-based superalloys for demanding mechanical and hydrogen-service environments

Manager, Electron Microscopy Group

Sep 2020 – Jul 2024

- ✧ Managed electron microscopy operations, user training, scheduling, maintenance coordination, procurement, and experimental support
- ✧ Led 10+ instrument workshops, trained 20+ users, and introduced a transparent and inclusive scheduling system

SELECTED RESEARCH CONTRIBUTIONS

1. Reversibly activating constrained phase transformations inside metals

Realizing reversible phase transformation of shape memory ceramics constrained in aluminum. *Nature Communications* 14, 7103 (2023). *First author*

Demonstrated reversible martensitic transformation within aluminium and revealed how confinement, interfaces, force-chain transfer, and matrix flow accommodate transformation strain.
2. Tuning and retaining metastability through chemistry and matrix constraint

Tuning metastable austenite in a phase-transforming ceramic via matrix constraint. *Acta Materialia* 276, 120118 (2024). *First author*

Established how chemical stabilisation and aluminium-matrix constraint jointly regulate retained austenite and its transformation accessibility in ceramic–metal composites.
3. Translating local phase transformation into bulk energy absorption

A transforming interpenetrating-phase cermet with high strength and energy absorption efficiency. *Materials Research Letters* 13, 51–59 (2025). *Corresponding author*

Used an interpenetrating architecture to couple transformation-enabled toughening with load sharing, producing a strong cermet with high energy-absorption efficiency.
4. Extending transformation-enabled reinforcement from ceramics to alloys

Deformable and transformable nitinol alloys enable enhanced strain hardening in aluminum. *Advanced Composites and Hybrid Materials* (2026). *Corresponding author*

Showed that NiTi fillers combine plastic deformation and stress-induced transformation to sustain strain hardening and improve the deformability of aluminium composites.
5. Linking thermal-history-controlled interface chemistry to mechanical reliability

Aging-mediated element redistribution to strengthen and toughen ceramic/metal interfaces. *Acta Materialia* 311, 122074 (2026). *Co-first author*

Connected ageing-controlled elemental redistribution with interfacial micromechanics through SANS, TEM, and local mechanical testing, identifying a balanced interfacial zone for strength and energy absorption.

FELLOWSHIP DISTINCTIONS & INDEPENDENT FUNDING

- | | |
|--|-----------|
| ○ Principal Investigator, NSFC PhD Programme, CNY 300,000 | 2024–2025 |
| ○ Shortlisted, Newton International Fellowship | 2026 |
| ○ Shortlisted, Glasstone Research Fellowship, University of Oxford | 2026 |

SELECTED AWARDS

○ Doctoral Student Innovation Award, Science and Technology Award of CMRS	2026
○ Outstanding Doctoral Graduate Development Scholarship, SJTU	2025
○ Gold Prize, Shanghai Career Development Competition (top 1% of entrants)	2025
○ National Scholarship for Graduate Students (top 5%)	2024
○ Outstanding Counsellor Award, SJTU	2023
○ Outstanding Teaching Assistant Award, SJTU	2022

PUBLICATIONS

(* - corresponding author; † - contribution equally)

Peer-Reviewed Articles

1. Y. Hu, **W. Zheng**, L. Zhao, Q. Guo*. Shape memory reinforced aluminum matrix composites for aerospace deployable structures: design strategies, constrained transformations, and intelligent properties. *Journal of Materials Engineering* (Accepted)
2. 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)
3. 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)
4. 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)
5. 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)
6. **W. Zheng**, S. Jia, L. Zhao, Q. Guo*, D. Zhang. Strengthening and Toughening Metal Matrix Composites via Transformation Engineering. *Materials China* 45, 754–763 (2026)
7. X. Wang*, Z. Zhao, **W. Zheng**, L. Zhao, X. Wang. Effect of 2-Methylimidazole as a Functional Latent Accelerator on the Properties of Low Temperature Curable Silver Conductive Paste. *Polymer Bulletin* 83, 569 (2026)
8. 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)
9. **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)
10. 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*

11. 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)
12. 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)
13. **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).
14. 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).
15. 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).
16. **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).
17. **W. Zheng**, L. Li, L. Zhao*, Q. Guo*. Design of shape memory ceramics: principles, strategies and perspectives. *JOM* 76, 3604-3621 (2024).
18. 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).
19. 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).
20. **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).
21. 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).
22. 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).
23. 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).
24. 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).

25. 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)

Patents

1. Q. Guo, **W. Zheng**, L. Li, L. Zhao, S. Jia. Energy-absorbing metal/ceramic composite granular packings and preparation method thereof, CN, 2025-09-16, ZL 2024 1 1866971.4
2. Q. Guo, **W. Zheng**, Y. Shi, Y. Han, Z. Ni, S. Jia, D. Zhang. Preparation method for aluminum-based composite material reinforced with shape memory ceramic and having adjustable austenite content, CN, 2025-03-25, ZL 2022 1 0560425.2 | PCT, WO 2023/226166 A1 | JP 7840594
3. Q. Guo, **W. Zheng**, X. Feng, L. Zhao. A method for testing the interfacial strength of cermets, CN, 2024-06-03, 202410707255.5.
4. Q. Guo, **W. Zheng**, L. Li, L. Zhao. A superelastic ceramic single crystal particle and preparation method thereof, CN, 2024-05-31, 202410694407.2.
5. Q. Guo, **W. Zheng**, L. Zhao. A transformation-induced-plasticity cermet and preparation method thereof, CN, 2024-04-30, 202410538132.3.
6. Q. Guo, Y. Han, G. Yang, **W. Zheng**. A graphene reinforced aluminum matrix composite and powder metallurgy preparation method thereof, CN, 2021-04-30, 112725660 A.

CONFERENCES & TALKS

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

7. May 2025, Paris, 6th International Conference on Materials Science, Engineering & Technology, "Transforming Fillers Enable Strong-and-Tough Metals", *Invited Presentation*
8. Mar 2025, Shanghai, Shanghai Jiao Tong University "Jiao-Chuang" Doctoral Academic Forum, "Transformation-induced strengthening and toughening in metal matrix composites", *Invited Presentation*
9. Dec 2024, Chongqing, 2nd International Conference on Heterostructured Materials (iHSM II), "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) and the second World Materials Conference, "Strengthening and Toughening Metal Matrix Composites via Transformation Engineering", *Invited Presentation*

PROFESSIONAL MEMBERSHIPS

- | | |
|---|--------------------|
| ○ Member, American Ceramic Society | Jul 2026 – Present |
| ○ Full Member, Sigma Xi | Jun 2026 – Present |
| ○ Member, Chinese Society for Composite Materials | Apr 2026 – Present |
| ○ Member, Chinese Materials Research Society | Feb 2026 – Present |

MENTORSHIP

- | | |
|---|----------------------------|
| Research Mentor | Dec 2025 – Aug 2026 |
| Harvard Undergraduate Association for U.S. Cross-Cultural Relations
Young Scholars Academic (YSA) | Cambridge, MA (Virtual) |
| <ul style="list-style-type: none"> ✧ 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 – Present |
| NTU, School of Materials Science and Engineering | Singapore |
| <ul style="list-style-type: none"> ✧ URECA's thesis (2), co-supervised with Prof. Chee Lip Gan | |
| SJTU, School of Materials Science and Engineering | Shanghai |
| <ul style="list-style-type: none"> ✧ Master's thesis (2); FYP/Capstone theses (5); Undergraduate Project (10+), co-supervised with Prof. Qiang Guo ✧ Several of which developed into peer-reviewed publications or ongoing collaborations | |

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

Academic Service & Leadership

- 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
- TEDxYouth, "Life is more than 0 and 1" Shanghai
Invited Speaker 19 Mar 2023

Peer Review

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

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