

## Hanhan Zhao

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### Reference:

- Chair Prof. Liangchi Zhang (SUSTECH) – Supervisor - zhanglc@sustech.edu.cn
- Prof. Asit Kumar Gain (SUSTECH) - Associate Research Professor - a.gain@sustech.edu.cn

### Education:

2014-2018	B.S.	Materials Engineering (TOP 11%), Nanchang University, Nanchang, China
2018-2021	M.Eng.	Materials Engineering (TOP 25%), Nanchang University, Nanchang, China
2021-2025	Ph. D.	Mechanics, Southern University of Science and Technology, Shenzhen, China

### Research Interest:

- Materials & Characterization
- Interface & Surfaces
- Machine Learning for Material Design

### Research Experience:

*A. Ph. D. Phase (2021-2025)*

**Thesis Topic:** Mold-Glass Interface Adhesion Mechanisms in Thermal forming

**Advisor:** Liangchi Zhang

**Description:** We conducted both qualitative and quantitative analyses of mold-glass adhesion mechanisms, integrating adhesion work calculations with dimensionless analysis and atomistic-level adhesion process evaluation. Molding temperature emerged as the key factor influencing adhesion during demolding, possibly attributed to increased atomic contact. Utilizing a custom-designed adhesion force measurement system, we developed parameter-matched glass-mold-process selection for glass molding technologies. Additionally, we explored interface contact mechanics and the evolution of adhesion distribution, extending this analytical approach to coatings like diamond-like carbon (DLC) to optimize thermal forming strategies. (NSFC\_Project)

*B. Undergraduate Phase (2018-2021)*

**Thesis Topic:** First-principle Calculations at the Phase Interface of Mg-Gd-Y Alloys

**Advisor:** Yong Liu

**Description:** We performed first-principles calculations based on density-functional theory to investigate the phase interfaces of rare-earth element alloys, focusing on  $\text{Mg}_{24}\text{Y}_5$  and  $\text{Mg}_3\text{Gd}$  with the Mg matrix. The atomic bonding and electronic structures were analyzed using orbital hybridization theory, and interfacial separation work was calculated to quantify bond strength. We proposed four variables—mismatch degree, interfacial spacing, crystal structure, and terminating atoms—to describe interfacial separation work as  $W_{\text{int}}=F(\theta, \mu, d, \epsilon)$ , illustrating how rare-earth elements enhance metal strength and corrosion resistance. (NKRDP\_Project)

[Personal Website](#)

[Google Scholar](#)

[Web of Science](#)

### Research Skills:

*A. Instrumentation Design*

- 2D/3D Modeling (Materials Studio, VASP, LAMMPS, Ovito)
- Analysis Software (e.g., MATLAB, Digital Micrograph, Jade, MultiPak)

#### *B. Thermal forming*

- Precision Molding, Probe Tack
- Material Preparation (e.g., CVD, Sputtering, PVD)
- Flexible Specimen Development (e.g., PMMA, Infrared glass)

#### *C. Materials characterization*

- Protective Coating, Bonding Analysis
- Multiscale Imaging (e.g., SEM, XRD, WLI, XPS, AFM, TEM, EELS)

#### *D. Language level*

- IELTS-7, Oral presentations at top-tier international conferences

### **Publications:**

#### *A. First author publications:*

- [A5] Hanhan Zhao, Liangchi Zhang, **“Mold-Glass Interface Adhesion Mechanisms in Precision Glass Molding”** [Advanced Optical Technologies \(Invited\)](#) (Under Review)
- [A4] Hanhan Zhao, Liangchi Zhang, Asit Kumar Gain, Zhen Li, **“Assessment of CrN/WC Molds: Surface Adhesion in Precision Glass Molding”** [Journal of Non-Crystalline Solids](#) (Review Completed)
- [A3] Hanhan Zhao, Liangchi Zhang, **“Predicting the Mold-Glass Interface Adhesion in Thermal Molding”** [International Journal of Mechanics Science](#) (Revision Completed)
- [A2] Hanhan Zhao, Liangchi Zhang, **“Evaluating the Demolding Adhesion in Glass Molding”** The 25th International Symposium on Advances in Abrasive Technology, 10 – 13, Dec, 2023.
- [A1] Hanhan Zhao, Asit Kumar Gain, Zhen Li, Liangchi Zhang, **“Wear of Mold Surfaces: Interfacial Adhesion in Glass Molding”** [WEAR](#) 204847, 524-525, 2023.

#### *B. Other cooperative publications:*

- [B2] Weicheng Wang, Jinlong Liu, [Hanhan Zhao](#), et al. **“Enhanced Mg/graphene interface adhesion using intermediate MgO layers: First-principles prediction and analysis”** [T NONFERR METAL SOC](#) 472 - 482, 32(2), 2022.
- [B1] Yuhao Guo, Weicheng Wang, Hanqing Huang, [HanHan Zhao](#), et al. **“Effect of doping Zn atom on the structural stability, mechanical and thermodynamic properties of AlLi phase in Mg–Li alloys from firstprinciples calculations”** [Philosophical Magazine](#) 1849 -1867, 100(14), 2020.

### **Patents:**

- [1] Liangchi Zhang, [Hanhan Zhao](#), Zhen Li. **“characterization of adhesion in thermal molding processes”**, [China Patent](#), CN116872474A, 2023-06-13.
- [2] Liangchi Zhang, [Hanhan Zhao](#), Zhen Li. **“automatic force measurement system”**, [China Patent](#), CN219838090U, 2023-10-17.

### **Awards and Honors:**

- Outstanding Graduate Student, Southern University of Science and Technology (2022-2023)
- Second "Star of the School of Engineering" Award, Southern University of Science and Technology
- Outstanding Graduate Teaching Assistant, Southern University of Science and Technology (2022)
- Second-class Graduate Academic Scholarship, Nanchang University (2019-2020)
- Second-class Undergraduate Scholarship, Nanchang University (2016-2017)
- First-class Undergraduate Scholarship, Nanchang University (2015-2016)