

Hanhan Zhao

College of Engineering

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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

Research Experience:

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

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

Description: This study focuses on the adhesion mechanism on the mold surface in the precision molding of glass optical elements. Starting from the formation mechanism of the adhesion at the interface between the glass and the mold, we systematically investigated the influences of the mold material, surface roughness, mechanical deformation of the glass, and the parameters of the molding process on the adhesion behaviors and combined them with the macroscopic experimental measurements, theoretical analyses, and molecular dynamics simulations, to reveal the evolutionary law and the formation mechanism of the adhesion force. Key highlights of my research include: (1) The high-temperature deformation behavior of glass was analyzed, with particular attention to viscosity evolution and microstructural changes with SEM/XRD/TEM characterization methods. (2) A high-precision measurement system was established to quantify adhesion forces during the demolding process of planar molds with DLC/AlCrN/WC molds. (3) A quantitatively predictive model for adhesion forces was developed based on dimensional analysis, integrating key factors such as the thermal deformation characteristics of glass, mold properties, interfacial adhesion energy, and processing conditions. (4) The adhesion behavior of CrN-coated molds was further examined through molding experiments, with a focus on the evolution of adhesion regions and the role of elemental diffusion in coating performance degradation. (NSFC_Project)

B. Undergraduate Phase (2018-2021)

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

Description: We performed first-principles calculations based on density-functional theory to investigate the phase interfaces of rare-earth element alloys, focusing on Mg₂₄Y₅ and Mg₃Gd 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 $W_{int}=F(\theta, \mu, d, e)$, illustrating how rare-earth elements enhance metal strength and corrosion resistance. (NKRD 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

- 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, Raman, 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 Revision)
- [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](#) (Under review)
- [A3] Hanhan Zhao, Liangchi Zhang, “**Evaluating the Demolding Adhesion in Glass Molding**” The 25th International Symposium on Advances in Abrasive Technology, 10 – 13, Dec, 2023.
- [A2] Hanhan Zhao, Liangchi Zhang, “**Predicting the Mold-Glass Interface Adhesion in Thermal Molding**” [International Journal of Mechanics Science](#) (Just Accepted)
- [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:

- [B1] 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.

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)