Geonjin Shin

Curriculum vitae

Department of Materials Science and Engineering
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Education

2021–Present **Ph.D. Candidate in Materials Science and Engineering**, *Seoul National University*, Seoul, Republic of Korea
Advisor: Prof. Myoung-Gyu Lee

2015–2021 **Bachelor of Science in Materials Science and Engineering**, *Seoul National University*, Seoul, Republic of Korea

Research Interests

My research focuses on the simulation of multi-physics phenomena through thermodynamically consistent constitutive modeling to understand deformation and fracture in metallic materials, particularly under hydrogen environments. I employ continuum thermodynamics and Integrated Computational Materials Engineering (ICME) approaches to analyze hydrogen-assisted mechanical degradation and to develop reliable hydrogen-compatible structural materials.

Topics
- Multiphysics constitutive modeling and continuum thermodynamics
- Governing-equation-based modeling and finite element implementation
- ICME modeling of hydrogen diffusion and hydrogen-assisted damage
- Mesh-independent fracture and instability modeling
- Structural instability under thermo-mechanical processes

Publications

International Journals (as first author)

[1] **G. Shin**, J. Park, S. Y. Song, K. Kim, H. J. Kim, S. S. Sohn, M. G. Lee, "Modeling the Transition from Ductile to Brittle Fracture Induced by Hydrogen-Assisted Mechanical Degradation in Quenching and Partitioning (Q&P) Steel," Available at SSRN 5209021.

[2] H.-J. Kim, **G. Shin**, J. Park, M.-G. Lee, "Pre-strain and hydrogen charging effect on the plastic and fracture behavior of quenching and partitioning (Q&P) steel," *Acta Materialia*, 119524 (2024).

[3] J. Park, **G. Shin**, H. N. Han, M.-G. Lee, "Effect of Orientation Selection Scheme of Nucleus on Discontinuous Dynamic Recrystallization: Analysis with Multiscale Modeling Approach," *Materials Transactions*, 63(10), 1351–1358 (2022).

International Journals (as co-author)

[4] J. Park, **G. Shin**, K. Kim, T. Park, F. Pourboghrat, S. S. Sohn, M.-G. Lee, "Modeling Hydrogen Diffusion and Its Interaction with Deformed Microstructure Involving Phase Transformation–Theory, Numerical Formulation, and Validation," *International Journal of Plasticity*, 104377 (2025).

[5] J. Park, **G. Shin**, H.-J. Kim, K. Kim, Y. S. Chae, S. S. Sohn, M. G. Lee, "A continuum scale chemo-mechanical model for multi-trap hydrogen transport in deformed polycrystalline metals," *International Journal of Plasticity*, 173, 103890 (2024).

Papers under review or in preparation

[6] S. Choi, **G. Shin**, J. Ahn, H. Bong, K. Min, M.-G. Lee, "From Taylor to Sachs: An Intermediate Constraint Based on a Single Microstructural Parameter," submitted.

[7] S. Song, **G. Shin**, M.-G. Lee, S.-S. Sohn, "' "Roles of microstructural constituents and crystallographic texture on hydrogen-induced delayed fracture behavior in Q&P steels," submitted.

[8] S.-G. Choi, S.-H. Kang, S.-H. Lee, **G. Shin**, S.-K. Kang, "Electrochemically Synchronized, Self-Indicating Iontophoretic Patch with Fully Eco-Degradable and Self-Powered System," in preparation.

[9] **G. Shin**, J. Park, M.-G. Lee, "Gradient-extended hydrogen embrittlement model in finite strain regime," in preparation.

Domestic Journals (English Translation)

[10] K. Kim, Y. Park, J. Chun, H. Kim, S. Byun, **G. Shin**, S. Yoon, "Prediction of Hole Expansion Formability of Hot-Rolled Ultra-High-Strength Steel Using a Strain-Based Ductile Fracture Model," *Journal of Metal Forming*, 33(6), 413–420 (2024).

[11] K. Kim, H. Kim, S. Yoon, J. Hyun, **G. Shin**, J. Park, M.-G. Lee, "Finite Element Modeling of Hydrogen Embrittlement in Martensitic Steel," *Trans. Mater. Process.*, 32(5), 287–293 (2023).

Awards and Honors

07/2024 Best Poster Award, 16th Steel Science Forum.

11/2023 Best Oral Presentation Award, Korea Institute for Advancement of Technology.

10/2023 Best Oral Presentation Award, The Korean Institute of Metals and Materials.

10/2022 Best Poster Award, The Korean Institute of Metals and Materials.

10/2021 Best Poster Award, The Korean Institute of Metals and Materials.

2021–Present BK21 Fellowship.

Research Projects

03/2022–Present **HyFEM: Fully coupled deformation–hydrogen transport–fracture simulation system for hydrogen-related failure prediction**, funded by NRF Korea.

04/2023–03/2024 **Multiscale and multiphysics modeling of pattern wiggling in dry etching**, funded by Samsung Electronics.

05/2022–06/2024 **Multiscale modeling of hydrogen embrittlement in advanced high-strength steels**, funded by Hyundai Steel.

03/2021–02/2023 **Graduate Educational Traineeship Program for Future Steels/Metals**, funded by KIAT.

Skills

Languages Korean (native), English (moderately good).

Software Abaqus, Python, Fortran, MATLAB, Mathematica, LaTeX, FEniCSx.

Experimental Mechanical testing (tension, tension–compression, bulge test, Nakajima test); Digital image correlation (VIC-2D, VIC-3D); Microstructural analysis: SEM, EBSD.