**Geonjin Shin**

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# Education

Mar. 2021 ~ Ph.D. candidate in Materials Science and Engineering

Present **Seoul National University**, Republic of Korea

(Advisor: Prof. Myoung-Gyu Lee)

Mar. 2015 ~ Bachelor of Science in Materials Science and Engineering

Feb. 2021**Seoul National University**, Republic of Korea

# Research Interest

My research interest centers on the simulation of multi-physics phenomena through thermodynamics-based constitutive equation modeling to achieve a comprehensive understanding of these complex processes. My primary focus is on analyzing the deformation and fracture behavior of metals in hydrogen environments by employing continuum thermodynamics and Integrated Computational Materials Engineering (ICME) approach. Through this work, I aim to uncover the underlying mechanisms that govern material behavior under such conditions, ultimately contributing to the development of reliable material in hydrogen environment and the optimization of metal processing to prevent potential hydrogen-induced fracture. My research has significant implications for improving the safety, reliability, and performance of materials used in hydrogen storage and other related technologies.

* **Multiphysics modeling**
* Thermodynamically consistent constitutive modeling
* Modeling Multiphysics phenomena via governing equations and finite element implementation
* **Application of ICME approach**
* Modeling hydrogen diffusion and embrittlement under deformation based on continuum thermodynamics
* Development of mesh-independent fracture model
* Structural instability analysis through thermo-mechanical load and deformation-dependent load

# Publications

International Journals

1. Park, J., **Shin, G.**, Kim, K., Park, T., Pourboghrat, F., Sohn, S. S., & Lee, M. G. (2025). Modeling Hydrogen Diffusion and Its Interaction with Deformed Microstructure Involving Phase Transformation–Theory, Numerical Formulation, and Validation., ***Int. J. Plast.***, 104377.
2. 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”, ***Int. J. Plast.***, 173, 103890 (2024).
3. 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 Mater.***, 119524 (2024).
4. 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”, ***Mater. Trans.***, 63(10), 1351-1358 (2022).

Papers under review or in preparation

1. **Shin, G.**, Park, J., Song, S. Y., Kim, K., Kim, H. J., Sohn, S. S., & Lee, M. G. 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. S. Choi, **Shin, G.**, J. Ahn, H. Bong, K. Min, M.-G.Lee, From Taylor to Sachs: An Intermediate Constraint Based on a Single Microstructural Parameter, submitted
3. **G. Shin**, J. Park, M.-G. Lee “Gradient-extended hydrogen embrittlement model in finite strain regime”, in preparation.

Korean Domestic Journals

1. 김기정, 김혜진, 윤승채, 현주식, **신건진**, 박진흥, 이명규, “마르텐사이트강의 수소취성 해석을 위한 유한요소 모델링 (Finite element modeling of hydrogen embrittlement in martensitic steel)”, ***한국소성가공학회지 (Trans. Mater. Process.)***, 32(5), 287-293 (2023).

# Awards and Honors

07/2024 **Best poster award**, 16th Steel Science Forum, Korea

11/2023 **Best oral presentation award from the president of Korea Institute for Advancement of Technology**, 2023 Industry-Academic Project Challenge, Korea

10/2023 **Best oral presentation award**, Korea Institute of Metals and Materials, Korea

10/2022 **Best poster award**, Korea Institute of Metals and Materials, Korea

10/2021 **Best poster award**, Korea Institute of Metals and Materials, Korea

03/2021 BK21 scholarship

~ Present

# Research Projects

03/2022 – Present “Fully coupled ‘Deformation-Hydrogen transport-Fracture’ simulation system (HyFEM) for enhancing reliability of metallic materials”, supported by National Research Foundation of Korea

04/2023 – 03/2024 “Multi-scale and Multi-physics modeling of pattern wiggling in dry etching process”, supported by Samsung Electronics Company

05/2022 – 06/2024 “Multi-scale modeling and simulation of hydrogen embrittlement in advanced high strength steels”, supported by Hyundai-Steel Company

# Skills

**Language**: Korean (native), English (moderately good)

**Software/Computer programming**: Abaqus, Python, Fortran, Matlab, Mathmatica

**Experiment**: Mechanical testing (Tension, Tension-compression test, Bulge test, Nakajima test etc)

**Characterization**: Digital image correlation (VIC-2d, 3d)