Program & Abstract

The 6th KIM-CSM symposium

Light alloy and steel for transportation: New materials and process, Integrated manufacturing, and Battery pack

Korea · Jeju

April 23-25, 2025

Organized by
Korea Institute of Metals and Materials (KIM)
The Chinese Society for Metals (CSM)
Supports by
Korea Institute of Materials Science(KIMS)

Title : ***Light alloy and steel for transportation: New materials and process, Integrated manufacturing, and Battery pack***

Organizer: Hyoung-Wook Kim(Korea Institute of Materials Science, Korea)
Hongzhou Lu,(CITIC Metal Co., LTD, China)

Preliminary Schedule

2025.4.23. (Wed.) 9:00 ~ 17:00: Registration & 2025 KIM Spring meeting(session)

2025.4.23. (Wed.) 17:00 ~ 19:00: Welcome dinner

2025.4.24.(Thurs.) 09:00 ~ 09:10: Welcome address (KIM & CSM President)

2025.4.24.(Thurs.) 09:10 ~ 12:00 : Morning Session(New process)

2025.4.24.(Thurs.) 12:00 ~ 13:20 : Lunch Break

2025.4.24.(Thurs.) 13:20 ~ 15:40 : Afternoon Session(New Materials)

2025.4.24.(Thurs.) 15:40 ~ 15:50 : Closing remark

2025.4.24.(Thurs.) 17:30 ~ 20:00 : KIM spring meeting ceremony & Official dinner

2025.4.25.(Fri) 09:00~ 11:00 : KIM spring meeting(session)

2025.4.25.(Fri) 11:00~ 13:00 : Symposium tour(주상절리) & Lunch, Closing

<Technical program>

(2025.4.24(Thursday))

Opening Ceremony

09:00 – 09:10 Welcome address (KIM President, CSM president (Video))

Session Title : Process and evaluation I

Time : 09:10 -10:30, Apr. 24, Room # : 202A, 2F

Session Chair : Hyoungwook Kim, Korea Institute of Materials Science**, Rui Ge**, Wuhan University of Science and Technology

09:10 – 09:30 **Zijian Wang**, Soochow University, Development and application of integrated hot stamping parts

09:30 – 09:50 **Hye-Jin Kim**, Tech. University of Korea, Enhancement of Hydrogen Delayed Fracture Resistance in High-Strength Hot-Stamped Boron Steel

09:50 – 10:10 **Xiangxing Deng**, Beijing Institute of Technology, Chongqing Innovation Center, Research and application of 1500 MPa free-coating and free-shot-blasting Nb-bearing PHS for integrated door rings

10:10 – 10:30 **Kyungseok Oh**, POSCO, Evaluation and modeling of the interfacial heat transfer coefficient between 1500MPa press hardening steel sheet and die surface in hot stamping

10:30 – 10:40 coffee break

Session Title : Process and evaluation II

Time : 10:40 -12:00, Apr. 24, Room # : 202A, 2F

Session Chair : Xiangxing Deng*, Beijing Institute of Technology, **Hye-Jin Kim**, Tech. University of Korea

10:40 – 11:00 **Youngung Jeong*,** Changwon National University, Springback of high strength steels predicted by finite element simulations using self-consistent polycrystal model

11:00 – 11:20 **Rui Ge***, Wuhan University of Science and Technology, Lightweight technology and application of battery pack box for new energy commercial vehicles

11:20 – 11:40 **Kyeongjae Jeong***, Sungkyunkwan University, A new technology for determining plastic anisotropy in structural materials

11:40 – 12:00 **Junying Min***, Tongji University, Laser-assisted Robotic Roller Forming of Ultrahigh Strength Steels

*Invited lecture

12:00 ~ 13:20 : Lunch Break

Session Title : New material for Light weight I

Time : 13:20 -14:40, Apr. 24, Room # : 202A, 2F

Session Chair : Jae-Hwang Kim, Korea Institute of Industrial Technology, **Bo Liu**, University of Science and Technology Beijing

13:20 – 13:40 **Yong-Nam Kwon***, KIMS, High cycle fatigue properties of thick plate steel for seashore structure depending on microstructures

13:40 – 14:00 **Yanchun Shi***, CITIC Metal Co., Ltd, Nb-enhanced FNC low dust emission brake rotors--A potential solution for Euro7 brake dust regulation

14:00 – 14:20 **Young-Min Kim***, KIMS, Advanced Non-Flammable Ca/Y-Containing Magnesium Alloys for Lightweight Structural Applications

14:20 – 14:40 **Wenhui Yao***, Chongqing University, Composite slippery liquid-infused porous surfaces for superior self-healing of Mg alloys

14:40 – 15:00 coffee break

Session Title : New material for Light weight II

Time : 15:00 -15:40, Apr. 24, Room # : 202A, 2F

Session Chair : Young-Min Kim, Korea Institute of Materials Science

15:00 – 15:20 **Jae-Hwang Kim***, Korea Institute of Industrial Technology, Effects of User-Defined Parameters on Cluster Analysis in Al-Mg-Si Alloys

15:20 – 15:40 **Bo Liu and Jian Yang***, University of Science and Technology Beijing, Research on non-homogeneity of super-large thin-walled aluminum alloy die-casting vehicle structural parts

Closing remarks

15:40 – 15:50 Closing remarks

*Invited lecture

Invited lecturer

CSM

CSM1 **Xiangxing Deng**, Beijing Institute of Technology Chongqing Innovation Center, Research and application of 1500 MPa free-coating and free-shot-blasting Nb-bearing PHS for integrated door rings

CSM2 **Rui Ge**, Wuhan University of Science and Technology, Lightweight technology and application of battery pack box for new energy commercial vehicles

CSM3 **Bo Liu and Jian Yang**, University of Science and Technology Beijing, Research on non-homogeneity of super-large thin-walled aluminum alloy die-casting vehicle structural parts

CSM4 **Junying Min**, Tongji University, Laser-assisted Robotic Roller Forming of Ultrahigh Strength Steels

CSM5 **Yanchun Shi**, CITIC Metal Co., Ltd, Nb-enhanced FNC low dust emission brake rotors--A potential solution for Euro7 brake dust regulation

CSM6 **Zijian Wang**, Soochow University, Development and application of integrated hot stamping parts

CSM7 **Wenhui Yao**, Chongqing University, Composite slippery liquid-infused porous surfaces for superior self-healing of Mg alloys

KIM

KIM1 **Kyeongjae Jeong**, Sungkyunkwan University, A new technology for determining plastic anisotropy in structural materials

KIM2 **Youngung Jeong,** Changwon National University, Springback of high strength steels predicted by finite element simulations using self-consistent polycrystal model

KIM3 **Jae-Hwang Kim**, Korea Institute of Industrial Technology, Effects of User-Defined Parameters on Cluster Analysis in Al-Mg-Si Alloys.

KIM4 **Hye-Jin Kim**, Tech. University of Korea, Enhancement of Hydrogen Delayed Fracture Resistance in High-Strength Hot-Stamped Boron Steel

KIM5 **Young-Min Kim**, Korea Institute of Materials Science, Advanced Non-Flammable Ca/Y-Containing Magnesium Alloys for Lightweight Structural Applications

KIM6 **Yong-Nam Kwon**, Korea Institute of Materials Science, High cycle fatigue properties of thick plate steel for seashore structure depending on microstructures

KIM7 **Kyungseok Oh**, POSCO, Evaluation and modeling of the interfacial heat transfer coefficient between 1500MPa press hardening steel sheet and die surface in hot stamping

CSM1

Research and application of 1500 MPa free-coating and free-shot-blasting Nb-bearing press hardening steel for integrated door rings

Xiangxing Deng[1], Cong Long[1], Jiaqi Song[1], Shuangshuang Liu[1], Jian Wang[1], Lintao Gui[1], Yongsheng Gao[1], Yan Zhao[1]

[1]Equipment Lightweight Technology Institute, Beijing Institute of Technology Chongqing Innovation Center, Chong Qing, 401120, Chian, xiangxing.deng@sydo.com.cn

Abstract

To address high costs associated with Al-Si coated 22MnB5, this study introduces LumiSword, a novel uncoated, free-shot-blasting press hardening steel. By optimizing Si and Cr micro-alloyed composition, LumiSword spontaneously forms a dense protective layer during heating, achieving high strength-toughness, oxidation resistance, and excellent weldability. Experimental results show a yield strength of 1190 MPa, tensile strength of 1734 MPa, elongation of 7%, with oxidation weight gain reduced by 87% compared to 22MnB5. Its corrosion resistance after 720-hour salt spray testing approached that of Al-Si coated 22MnB5. LumiSword demonstrated excellent welding performance, producing fully martensitic weld seams (510-560 HV2) without filler wires. On the industrial production line, LumiSword steel was successfully used for small-batch manufacturing of integrated door rings. Without shot blasting, these components underwent production line coating, achieving adhesion grade 0 with defect-free surfaces. Simulation analysis further verified that LumiSword's three-point bending fracture energy surpasses 22MnB5, enhancing impact resistance. Economically, LumiSword reduced costs by 15%-30% compared to Al-Si coated steel, while eliminating shot blasting lowers mold wear and energy consumption. By overcoming high cost and welding restrictions on Al-Si coatings, LumiSword provides a cost-effective solution for automotive lightweighting. Its industrial application is expected to accelerate multi-part integration technology in structural components, and low-carbon transformation in automotive industry.

Keywords: free-coating; Si-Cr micro-alloyed press hardening steel; oxidation resistance; mechanical properties;

CSM1

Curriculum Vitae

PERSONAL DATA

Name in Full Xiangxing Deng

Address Beijing Institute of Technology Chongqing Innovation Center, Chong Qing, 401120, Chian

Phone Business +86-023-61766972 (China)
Mobile +86-136-8649-0095

Email xiangxing.deng@sydo.com.cn

EDUCATION

2012. 6: Bachelor, Dept. of Mechanical Engineering, Hunan Institute of Engineering
2015.6: Master, Dept. of Materials Processing Engineering, South China University of Technology
2019.4: PhD, Materials Science and Engineering, University Carlos III of Madrid

PROFESSIONAL EXPERIENCE

2015.9– 2019.6: Assistant Research Fellow, IMDEA Materials Institute
2020.6 –2022.8: Postdoctoral Researcher, Beijing Institute of Technology
2022.9 – present: Researcher, Beijing Institute of Technology Chongqing Innovation Center

RECENT RELATED PUBLICATIONS

1) X. Pu, C. Long, X. X, Deng, J. Wang, L. T, Gui, J.S. Zhang, Z.B. Wang, X.M. Xu, Y. Zhao, H. Z, Lu, and Y. W, Wang. c ICHSU2014, Atlantis Highlights in Material Sciences and Technology, 2024, ISBN:978-94-6463-581-2
2) Xiangxing Deng, Ruonian Zheng, José Manuel Torralba, Andrea García-Junceda, Yangwei Wang. " Effect of C content on microstructure and mechanical properties of Cr-based hard composites obtained by different sintering methods". Materials Science and Engineering A. 2022, doi.org/10.1016/j.msea.2022.143377
3) Deng, X.X. Torralba, J.M. García-Junceda, A, Development of a new Cr-based hardmetal with nanosized tungsten carbide grain size through liquid-phase sintering and spark plasma sintering, PowderMet 2021, ISBN: 978-194369427-3.
4) Deng, X.X. Torralba, J.M. García-Junceda, A, Development of a new Cr-based hardmetal with nanosized tungsten carbide grain size through liquid-phase sintering and spark plasma sintering, PowderMet 2021, ISBN: 978-194369427-3
5) Xiangxing Deng, Darizs Garbiec, José Manuel Torralba, Jingya. Wang, Andrea García-Junceda. "Development and characterization of novel Cr-based hardmetals strengthened by nanosized tungsten carbide". Materials Science and Engineering A. 767 (2019) 138413. doi.org/10.1016/j.msea.2019.138413

CSM2

Lightweighting Technology and Application of Battery Packs for New Energy Commercial Vehicles

Rui Ge
（Wuhan University of Science and Technology，Wuhan，China）

The battery pack is a crucial safety component that houses the power battery system of new energy vehicles. It plays a vital role in ensuring the safe operation and protection of the product, and is directly related to the safety of the entire vehicle. Currently, aluminum alloys and composite materials used in the industry have prominent lightweight advantages. However, they suffer from issues such as high material costs, complex manufacturing processes, low production efficiency, and poor impact resistance. Traditional high - strength products, on the other hand, have low costs but are heavy in weight, which affects the driving range.
To develop ultra - high - strength steel battery pack boxes with higher strength levels, high strength - toughness, and lightweight characteristics, the following key technical problems need to be overcome:①High Precision: High - strength steel thin sheets have significant springback during forming, which increases the difficulty of product shape control. It is necessary to combine heat treatment processes with advanced forming processes to ensure product accuracy and improve the strength - plasticity product of ultra - high - strength steel sheets to meet comprehensive mechanical property requirements. ②Lightweight: When using steel to replace the current aluminum - based structures, it is essential to optimize the structural design and select materials rationally to offset the weight increase caused by the higher density of raw materials. At the same time, the safety requirements of the battery pack must be ensured.

Aiming at the above technical challenges, this project takes the development and application of lightweight, low - cost ultra - high - strength steel battery packs for new energy vehicles as its goal, and focuses on key technologies such as the structural design of steel battery packs, precision machining and forming of parts, and manufacturing, to effectively achieve the engineering demonstration application of products. The main research contents are as follows:
(1) Optimization Design of Lightweight Steel Battery Packs Based on the Integration of Structure - Material - Safety Performance. According to the design indicators of the entire vehicle, a finite - element model of the battery pack box is created, and modal and strength analyses are performed on the created finite - element model. According to relevant regulatory requirements, a simulation of the extrusion condition of the battery pack is carried out to evaluate the collision safety, and the safety design requirements for each condition are determined based on the simulation results.
(2) Combining the geometric features of part surfaces, the continuous cooling transformation characteristics of material heat treatment, and a new path for profile processing and forming, a set of integrated equipment for high - precision forming of parts and ultra - high strengthening and modification is developed. Furthermore, through the optimization of forming temperature, forming passes, and forming roll profiles, short - process and low - cost processing and manufacturing of ultra - high - strength profiles during the forming process are achieved.
(3) Two typical high - strength, tough, and lightweight battery pack products have been successively developed and successfully tested on vehicles and applied for demonstration. The battery pack box developed for new energy light trucks reduces the weight by approximately 107 Kg compared to the product developed with ordinary steel Q355 in the original plan. The ultra - high - strength lightweight battery pack box for commercial vehicles can reduce the weight of the battery pack for battery - swapping heavy trucks by approximately 124 Kg compared to the product developed with traditional high - strength steel QSTE700TM in the original plan.

CSM2

Curriculum Vitae

Rui Ge, Professor at Wuhan University of Science and Technology. He once worked at the Wuhan Branch of the Central Research Institute of Baoshan Iron & Steel Co., Ltd., serving as the Chief Researcher. Since 2008, he has been continuously committed to the innovation of high-strength steel and hot stamping forming technology as well as the industrial development.

He is mainly engaged in the development of ultra-high-strength steel varieties for automobiles, the research on hot stamping and hot roll forming technology, and the research on lightweight design of vehicle bodies.

In the past decade, he has successively presided over and carried out more than 20 projects, including sub-projects of the National Key Research and Development Program, major scientific and technological innovation projects at the provincial and ministerial levels, and joint research projects between universities and enterprises. He has published more than 20 scientific and technological academic papers and been authorized more than 40 patents. He has been awarded as an Excellent Engineer by the China Automotive Lightweight Technology Innovation Strategic Alliance.

CSM3

Research on non-homogeneity of super-large thin-walled aluminum alloy die-casting vehicle structural parts

Bo Liu[1,3,*], Jian Yang[1,2,3], Dongwei Shu[2]

[1]School of Mechanical Engineering, University of Science and Technology Beijing, Beijing, 100083, China, liubo1@ustb.edu.cn
[2]School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore, 639798, Republic of Singapore
[3]Beijing Key Laboratory of Lightweight Metal Forming, University of Science and Technology Beijing, Beijing, 100083, China

Abstract

Giga-casting technology is a revolutionary technology for lightweighting of new energy vehicles. However, for the ultra-large complex thin-walled giga-casting aluminum alloy automobile body structure parts process defects amplification, complex residual stress distribution, the feed end and the distal end of the mechanical properties of the large differences in the inhomogeneity of the outstanding, resulting in riveted parts easy to crack. And due to the inconsistency of the wall thickness, there is a large difference in the performance of the part, which cannot be analyzed as a uniform part with equal performance. This project intends to investigate the melt flow behavior, strain distribution law, and defect generation mechanism of heat-treatment-free aluminum alloy ultra-large complex thin-walled giga-castings from casting molding simulation. Meanwhile, a series of high-vacuum high-pressure casting experiments are carried out from the application level to analyze the effects of different process conditions on the organization and performance. Through tools such as big data and machine learning, construct data-driven process-organization-defect-property correlation models based on data. The unknown region mechanical properties are predicted by known parameters. The project will solve the problem of variation in part performance due to process and localized thickness variations by accurately predicting the performance of each part prior to molding and riveting. This ensures molding and joining quality, reduces the number of trial molds and rivets, shortens the development cycle, and lowers product costs.

Keywords: Automobile lightweighting; Giga-casting; Process parameter; Property prediction; Data driven

CSM3

Curriculum Vitae

PERSONAL DATA		
Name in Full	Bo Liu	
Address	Beijing Key Laboratory of Lightweight Metal Forming, University of Science and Technology Beijing, Beijing, 100083, China	
Mobile	+86 158 2396 2001	
Email	liubo1@ustb.edu.cn	

EDUCATION

1996-2001: Bachelor, College of Automotive Engineering, Jilin University

2001-2004: Master, College of Automotive Engineering, Jilin University

2004-2007: PhD, College of Automotive Engineering, Jilin University

PROFESSIONAL EXPERIENCE

Deputy director of expert committee of Automotive Lightweight Technology Innovation Strategic Alliance
Deputy director of the Non-metallic Materials Branch of the Chinese Society of Automotive Engineering
Deputy director of the Chongqing Institute of Materials
Special Expert of National New Energy Vehicle Technology Innovation Center
Member of the Automotive Materials Sub-Committee of China Automotive Engineering
2007-2011: Body design institute, Chongqing Changan Automobile Co., Ltd, Engineer
2011-2014: Advance technology institute, Chongqing Changan Automobile Co., Ltd, Senior engineer
2014-2016: Body development center, Chongqing Changan Automobile Co., Ltd, Senior engineer
2016-2019: Auchan automobile research institute, Chongqing Changan Automobile Co., Ltd, Senior engineer
2019-2021: Auchan automobile research institute, Chongqing Changan Automobile Co., Ltd, Senior Deputy Chief Engineer
2021-Now: School of Mechanical Engineering, University of Science and Technology Beijing, Professor
2021-Now: Executive Deputy Director of Beijing Key Laboratory of Lightweight Metal Forming
2019: China National Armaments and Equipment Corporation "Science and Technology Leader"
2020: Recipient of the State Council Special Allowance
2017: China Automotive Industry Outstanding Science and Technology Young Talent
2016: National Outstanding Science and Technology Worker
2014: Chongqing Outstanding Youth Fund Recipient

RECENT RELATED PUBLICATIONS

[1] Wu Y, Li P, **Liu B***, et al. Topology optimization for energy absorption of quasi-brittle structures undergoing dynamic fractures[J]. Advances in Engineering Software, 2024, 187: 103567.

[2] Zhang Y, **Liu B***, Liu Y, et al. Effect of Laser Processing Pattern on the Mechanical Properties of Aluminum Alloy Adhesive Joints[J]. Automotive Innovation, 2023, 6(4): 622-632.

[3] Zhang Y, Feng G, **Liu B***. Sensitivity analysis and multi-objective optimization strategy of the curing profile for autoclave processed thick composite laminates[J]. Polymers, 2023, 15(11): 2437.

[4] Hao X, Zhou D, **Liu B***, et al. Electrification pathways for light-duty logistics vehicles based on perceived

cost of ownership in Northern China[J]. Carbon Footprints, 2024, 3(3): N/A-N/A.

[5] **Liu B***, Tang Y, Wu Y, et al. Study on Lightweight Design of Integrated Mega-casting Aluminum Alloy Vehicle Body Components [J]. Automotive Innovation, 2024, 46(12): 2154-2163.

[6] **Liu B***, Wang K, Yang J, et al. Research and Application of Process Integration Design Method for Body-in-White Shock Tower [J]. Automotive Innovation, 2025, 47(1): 161-167.

[7] Yang J, **Liu B***, Shu D, et al. Vehicle giga-casting Al alloys technologies, applications, and beyond[J]. Journal of Alloys and Compounds, 2025: 178552.

[8] Yang J, **Liu B***, Shu D, et al. A novel method for estimating internal porosity and predicting tensile properties based on failure analysis of aluminum alloy die castings[J]. Engineering Failure Analysis, 2025: 109276.

[9] Yang J, **Liu B***, Shu D, et al. Local stress/strain field analysis of die-casting Al alloys via 3D model simulation with realistic defect distribution and RVE modelling[J]. Engineering Failure Analysis, 2024: 109104.

[10] Yang J, **Liu B***, Zeng Y. Data extension-based analysis and application selection of process-composition-properties of die casting aluminum alloy[J]. Engineering Applications of Artificial Intelligence, 2024, 133: 108514.

[11] Yang J, **Liu B***, Huang H. Research on composition-process-property prediction of die casting Al alloys via combining feature creation and attention mechanisms[J]. Journal of Materials Research and Technology, 2024, 28: 335-346.

[12] **Liu B***, Yang J, et al. Research on Welding Deformation Control Technology of Battery Electric Vehicle Framed Aluminum Body[J]. Progress in Natural Science: Materials International.

[13] **Liu B***, Yang J, Zhang X, et al. Topology Optimization and Lightweight Platform Development of Pure Electric Vehicle Frame-Type Aluminum Body Considering Crash Performance[J]. Journal of Materials Engineering and Performance, 2024: 1-11.

[14] Yang J, **Liu B**, Zhang T, et al. Multi-parameter controlled mechatronics-electro-hydraulic power coupling electric vehicle based on active energy regulation[J]. Energy, 2023, 263: 125877.

[15] Yang J, **Liu B**, Zhang T, et al. Application of energy conversion and integration technologies based on electro-hydraulic hybrid power systems: A review[J]. Energy Conversion and Management, 2022, 272: 116372.

[16] **Liu B***, Yang J, Zhang X, et al. Development and application of magnesium alloy parts for automotive OEMs: A review[J]. Journal of Magnesium and Alloys, 2023, 11(1): 15-47.

[17] **Liu B***, Yang J, Yang Q, et al. Application and Lightweight Research of QP1180 High Strength Steel in Autobody Reinforcement Part[C]//Proceedings of the 6th International Conference on Advanced High Strength Steel and Press Hardening (ICHSU 2022). Springer Nature, 2023, 2: 311. ISBN：978-94-6463-114-2.

[18] **Liu B**, Yang J, Tang Y, et al. Experimental study on structural adhesive properties of aluminum plate and carbon fiber-reinforced polymer heterogeneous materials[J]. Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, 2023: 09544089231190303.

[19] **Liu B**, Yang J, Zhang X, et al. Development and Low Cost Control of Glass Fiber Reinforced Thermoplastic Composites-Based Electric Vehicle Tailgate[J]. Journal of Materials Engineering and Performance, 2023: 1-22.

CSM3

PERSONAL DATA

Name in Full	Jian Yang
Address	• Beijing Key Laboratory of Lightweight Metal Forming, University of Science and Technology Beijing, Beijing, 100083, China • School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore, 639798, Republic of Singapore
Mobile	+86 173 7221 2725 +85 8941 8541
Email	d202210329@xs.ustb.edu.cn

EDUCATION

2015-2019: Bachelor, University of Science and Technology Beijing, Liaocheng University
2019-2022: Master, University of Science and Technology Beijing, Qingdao University
2022-Now: PhD, School of Mechanical Engineering, University of Science and Technology Beijing
2024-2025: Visiting PhD, School of Mechanical and Aerospace Engineering, Nanyang Technological University

RECENT RELATED PUBLICATIONS

[1] **Yang J**, Liu B, Shu D, et al. Vehicle giga-casting Al alloys technologies, applications, and beyond[J]. Journal of Alloys and Compounds, 2025: 178552.

[2] **Yang J**, Liu B, Shu D, et al. A novel method for estimating internal porosity and predicting tensile properties based on failure analysis of aluminum alloy die castings[J]. Engineering Failure Analysis, 2025: 109276.

[3] **Yang J**, Liu B, Shu D, et al. Local stress/strain field analysis of die-casting Al alloys via 3D model simulation with realistic defect distribution and RVE modelling[J]. Engineering Failure Analysis, 2024: 109104.

[4] **Yang J**, Liu B, Zeng Y. Data extension-based analysis and application selection of process-composition-properties of die casting aluminum alloy[J]. Engineering Applications of Artificial Intelligence, 2024, 133: 108514.

[5] **Yang J**, Liu B, Huang H. Research on composition-process-property prediction of die casting Al alloys via combining feature creation and attention mechanisms[J]. Journal of Materials Research and Technology, 2024, 28: 335-346.

[6] Liu B, Wang K, **Yang J**, et al. Research and Application of Process Integration Design Method for Body-in-White Shock Tower [J]. Automotive Innovation, 2025, 47(1): 161-167.

[7] Liu B, **Yang J**, et al. Research on Welding Deformation Control Technology of Battery Electric Vehicle Framed Aluminum Body[J]. Progress in Natural Science: Materials International.

[8] Liu B, **Yang J**, Zhang X, et al. Topology Optimization and Lightweight Platform Development of Pure Electric Vehicle Frame-Type Aluminum Body Considering Crash Performance[J]. Journal of Materials Engineering and Performance, 2024: 1-11.

[9] **Yang J**, Liu B, Zhang T, et al. Multi-parameter controlled mechatronics-electro-hydraulic power coupling electric vehicle based on active energy regulation[J]. Energy, 2023, 263: 125877.

[10] **Yang J**, Liu B, Zhang T, et al. Application of energy conversion and integration technologies based on electro-hydraulic hybrid power systems: A review[J]. Energy Conversion and Management, 2022, 272: 116372.

[11] **Yang J**, Zhang T, Hong J, et al. Research on driving control strategy and Fuzzy logic optimization of a novel mechatronics-electro-hydraulic power coupling electric vehicle[J]. Energy, 2021, 233: 121221.

[12] Liu B, **Yang J**, Zhang X, et al. Development and application of magnesium alloy parts for automotive OEMs: A review[J]. Journal of Magnesium and Alloys, 2023, 11(1): 15-47. https://doi.org/10.1016/j.jma.2022.12.015.
[13] **Yang J**, Zhang T, Zhang H, et al. Electro-hydraulic Power Switching Control for Mechatronics-Electro-Hydraulic Power Coupling Electric Vehicles Considering Optimal Speed Thresholds[J]. Energy Technology.
[14] Liu B, **Yang J**, Yang Q, et al. Application and Lightweight Research of QP1180 High Strength Steel in Autobody Reinforcement Part[C]//Proceedings of the 6th International Conference on Advanced High Strength Steel and Press Hardening (ICHSU 2022). Springer Nature, 2023, 2: 311.
[15] Liu B, **Yang J***, Tang Y, et al. Experimental study on structural adhesive properties of aluminum plate and carbon fiber-reinforced polymer heterogeneous materials[J]. Proceedings of the Institution of Mechanical Engineers, Part E: Journal of Process Mechanical Engineering, 2023: 09544089231190303.
[16] Liu B, **Yang J**, Zhang X, et al. Development and Low Cost Control of Glass Fiber Reinforced Thermoplastic Composites-Based Electric Vehicle Tailgate[J]. Journal of Materials Engineering and Performance, 2023: 1-22.
[17] Hong J, Ma F, Xu X, **Yang J***, et al. A novel mechanical-electric-hydraulic power coupling electric vehicle considering different electrohydraulic distribution ratios[J]. Energy Conversion and Management, 2021, 249: 114870. DOI: j.enconman.2021.114870.
[18] **Yang J**, Zhang T, Zhang H, et al. Research on the starting acceleration characteristics of a new mechanical–electric–hydraulic power coupling electric vehicle[J]. Energies, 2020, 13(23): 6279.
[19] Pan Z, Yang C, **Yang J**[1], et al. Accelerated performance optimization of drive axle housings based on the pseudo-damage reservation method[J]. Sustainable Energy Technologies and Assessments, 2022, 53: 102612.

CSM4

Laser-assisted Robotic Roller Forming of Ultrahigh Strength Steels

Junying Min[1], Songgang Zheng[2], Zeran Hou[1]

[1]School of Mechanical Engineering, Tongji University, Shanghai, 201804, China

Junying.min@tongji.edu.cn

[2]MASTER, Tianjin, China

Abstract

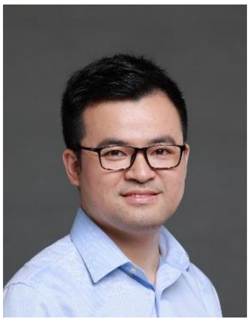
A novel flexible forming process has been proposed to fabricate ultrahigh strength steels wi th tensile strengths higher than 1400 MPa, where the steel sheet is synchronously heated with a laser spot and formed by a roller or two rollers that are equipped on industrial robots. Th e novel process is termed as Laser-assisted Robotic Roller Forming (LRRF). The temperatures and microstructures of steel sheets during LRRF are investigated experimentally and numeric ally. We will present some applications of LRRF to ultrahigh strength steel beams of lightwei ght battery tray and car body structure.

Keywords: Robotic forming, Laser-assisted forming, Battery tray

CSM4

Curriculum Vitae

PERSONAL DATA



Name in Full Junying Min

Address School of Mechanical Engineering, Tongji University
Cao An Road 4800, Shanghai 201804, China

Phone Business +86-21-69599750 (China)
Mobile
Fax.
Email Junying.min@Tongji.edu.cn

EDUCATION

2007. 6 : Bachelor, Mechanical Engineering, Tongji University
2012.12: PhD, Mechanical Engineering, Tongji University

PROFESSIONAL EXPERIENCE

From March 2017, Full Professor, School of Mechanical Engineering, Tongji University
May 2018 – Jul. 2018, Visiting Professor, Institute of Forming Technology and Lightweight Components (IUL), TU Dortmund
Jan. 2015 – Feb. 2017, Postdoc (Alexander von Humboldt Fellow), Mechanical Engineering, Ruhr-University Bochum
Mar. 2013 – Dec. 2014, Visiting Scientist (adjunct), Lab of Lightweight Material Processing, General Motors Global R&D Center
Aug. 2013 – Dec. 2014, Postdoc, Mechanical Engineering, University of Michigan
Feb. 2013 – Aug. 2013, Postdoc, Mechanical Engineering, University of Hawaii
Jan. 2011 – Jul. 2011, Visiting Scientist, Lab of Lightweight Material Processing, General Motors Global R&D Center

RECENT RELATED PUBLICATIONS

[1] Liu Y, Qiu J, Wang J, Lian J, Hou Z, Min J*. An iterative path compensation method for double-sided robotic roller forming of compact thin-walled profiles. Robotics and Computer-Integrated Manufacturing 86(2024)102689.
[2] Liu Y, Wang J, Cai W, Carlson BE, Lian J, Min J*. A thermo-metallurgical-mechanical model for microstructure evolution in laser-assisted robotic roller forming of ultrahigh strength martensitic steel. Journal of Materials Research and Technology. 25(2023) 451-464
[3] Liu Y, Min J*, Zhang J, Cai W, Carlson BE, Bobel AC, Hector Jr. LG, Sachdev AK. Laser-assisted robotic roller forming of an ultrahigh strength martensitic steel. Journal of Manufacturing Processes. 82 (2022) 192–202.
[4] Min J, Wang J, Lian J, Liu Y*, Hou Z. Laser-Assisted Robotic Roller Forming of Ultrahigh-Strength Steel QP1180 with High Precision. Materials 16 (2023) 1026.
[5] Hou Z, Liu Y, He Q, Wang J, Min J*. Low-Carbon-Emission Hot Stamping: A Review from the Perspectives of Steel Grade, Heating Process, and Part Design. Automotive Innovation. 6, 324–339 (2023).
[6] Hou Y, Lee MG, Lin J, Min J*. Experimental characterization and modeling of complex anisotropic hardening in quenching and partitioning (Q&P) steel subject to biaxial non-proportional loadings. International Journal of Plasticity. 156(2022)103347

CSM5

Nb-enhanced FNC low dust emission brake rotors--A potential solution for Euro7 brake dust regulation

Yanchun Shi[1], Bernardo Barile[2], Jianfeng Wang[3], Mike Holly[2]，Hongzhou Lu[1]，Wenjun Wang[1], Aimin Guo[1]

[1]CITIC Metal Co., Ltd, Bejing,China, shiyc@citic.com; [2] CBMM, Brazil;[3] General Motors China Science Lab, Shanghai, China;

Abstract

The Euro 7 emission standard has been approved by European Commission in April,2024 and entered force in May 2024. The New standard requires to reduce “dust emissions” for both brake disc and friction materials. The conventional gray iron disc and brake pad combination is facing severe challenges in meeting new standards. Ferritic Nitrocarburization (FNC) is a mature surface treatment technology to increase surface strength, hardness and corrosion resistance. Niobium is an effective strengthening element in gray iron to enhance matrix strength, hardness and wear resistance. Preliminary lab trials have proven that niobium-alloyed ferritic nitrocarburized gray iron brake discs can offer the desirable combination of corrosion and wear resistance, therefore it becomes a potential solution for Euro 7 brake dust regulation. Preliminary industrial trial shows that 0.2% Nb addition combined with FNC treatment could provide gray iron disc nearly 50% particle emissions reduction. It is a promising low-cost solution to meet Euro7 brake dust regulation.

Keywords: Nb alloyed GCI, Ferritic Nitrocarburization, brake dust emission,

CSM5

Curriculum Vitae

PERSONAL DATA

Name in Full Yanchun Shi

Address CITIC Metal Co., Ltd,
No.6, Xinyuannanlu, Chaoyang Dist,Beijing,China.
Phone Business +86-10-5966-2081 (China)
Mobile +86-13811063235
Fax. +86-10- 84865089
Email shiyc@citic.com

EDUCATION

2005. 7: Bachelor, Dept. of Materials Science & Engineering, Zhengzhou University
2008. 7: Master, Dept. of Materials Science & Engineering, Inner Mongolia University of Science and Technology

PROFESSIONAL EXPERIENCE

2008.7– 2017.5 : Material engineer, MCC Overseas Ltd
2017.5 –present : Engineer and promotion manager, CITIC Metal Co., Ltd

RECENT RELATED PUBLICATIONS

1) Mike Holly, Andrew Halonen, Erico Franc, et al. Niobium-Alloyed Ferritic Nitrocarburized Brake Rotors, rake Colloquium & Exhibition, SAE,2023
2) H. Mohrbacher, Q. Zhai, et,al, Niobium alloying in grey cast iron for vehicle brake discs, Materials Science and Technology (MS&T) 2011

CSM6

Development and application of integrated hot stamping parts

Zijian Wang[1], Xiao Liang[2], Ze peng[2], Chongchen Xiang[1], and Hanlin Ding[1]

[1]School of Iron and Steel, Soochow University, Suzhou 215000, Jiangsu, China, wangzijian@suda.edu.cn

[2]Jiangxi Hot Stamping Automotive Component Co., Ltd

Abstract

Hot stamping is a crucial manufacturing process for achieving automotive lightweighting and enhancing vehicle safety performance. With the widespread adoption of hot stamping in the automotive industry, the integrated door ring design has gradually gained application. This integrated design effectively reduces overlapping areas between components, optimizes force transmission paths during collisions, thereby achieving dual benefits of reducing total vehicle weight and improving crash performance. Meanwhile, the reduced number of body structural components lowers both die and vehicle assembly costs, making the integrated door ring design more cost-effective. In the design process of integrated door ring dies, special attention must be paid to the impact of weld seam positions on component formability. To ensure relatively uniform cooling rates across different regions of the door ring, varied die materials and customized cooling channel designs are required in distinct areas to maintain cooling consistency, ultimately guaranteeing dimensional accuracy of formed components. During the process design phase, numerical simulation methods are employed to predict potential cracking and wrinkling defects, with subsequent modifications made to component geometry and forming processes to prevent forming failures. The integrated door ring design methodology presented in this study has been successfully implemented in GAC Aion vehicles, demonstrating enhanced vehicle performance and delivering significant economic benefits.

Keywords: Hot stamping, Dooring, Numerical simulation, Die design, Crack and wrinkle

CSM6

Curriculum Vitae

PERSONAL DATA

Name in Full Zijian Wang

Address School of Iron and Steel,
No. 8, Jixue Road, Xiangcheng District, Suzhou, Jiangsu Province, China

Phone Business /
Mobile +86-17620598717 (China)

Fax. /

Email wangzijian@suda.edu.cn

EDUCATION

2011. 6: Bachelor, School of Materials Science and Engineering, Huazhong University of Science and Technology

2017. 3: PhD, School of Materials Science and Engineering, Huazhong University of Science and Technology

PROFESSIONAL EXPERIENCE

2017.3– 2020.3 : Postdoctoral researcher, Huazhong University of Science and Technology

2020.4 – present : Associate Professor, School of Iron and Steel, Soochow University

RECENT RELATED PUBLICATIONS

1) Zijian Wang; Hanlin Ding; Zhendong Xiao; Chenxi Yang; Chongchen Xiang ; Experimental investigation on the mechanical properties and strain rate sensitivity of Mg-Al-Ca-Mn alloy under various strain rates, Materials Science and Engineering A-structural Materials Properties Microstructure and Processing, 2021, 826: 141997
2) Zijian Wang; Chongchen Xiang; Yisheng Zhang ; Investigation into constitutive and fracture modeling of hot stamped parts with multiphase, Mechanics of Advanced Materials and Structures, 2021, 1: 1-13
3) Wang, Zijian; Zhang, Xiaolei; Gui, Jiangtao; Geng, Huicheng; Xiang, Chongchen; Ding, Hanlin ; Study on Constitutive Model and Fracture Criterion of 7075 Aluminum Alloy at High Temperature, Journal of Materials Engineering and Performance, 2024, 1(1): 1-11
4) Senzhen Wang; Shun Xu; Chongchen Xiang; Zijian Wang; Hanlin Ding ; The effect of neighboring grain orientation on dislocation-grain interaction in Ti-5553 alloy, Materials Characterization, 2022, 192: 112219-112219
5) Chongchen Xiang; Yuanyuan Xu; Yi Yang; Hanlin Ding; Zijian Wang ; Plastic deformation mechanisms and constitutive modeling of WE43 magnesium alloy at various strain rates and temperatures, Journal of Materials Research and Technology, 2024

CSM7

Composite slippery liquid-infused porous surfaces for superior self-healing of Mg alloys

Wenhui Yao[1,2], Junyao Xu[1,2], Yan Yang[1,2], Jiangfeng Song[1,2], and Bin Jiang[1,2]

[1] College of Materials Science and Engineering, Chongqing University, Chongqing 400044, CHINA

[2] National Engineering Research Center for Magnesium Alloys, Chongqing University, Chongqing 400044, China

yaowh2012@cqu.edu.cn

Abstract

Light weighting of vehicles plays a crucial role in energy conservation and emission reduction. As one of the lightest engineering materials, magnesium (Mg) alloys show great potential for automotive lightweighting, due to their low density, excellent vibration damping, and good castability. Currently, they are primarily used in components such as steering wheels, seat brackets, and transmission housings. However, the relatively poor corrosion resistance of Mg alloys significantly restricts their wide applications in practice. Inspired by nature, slippery liquid-infused porous surfaces (SLIPSs) are developed to alleviate corrosion of metallic materials. Nevertheless, conventional SLIPSs provide relatively limited corrosion protection for Mg alloys. Herein, corrosion inhibitor of 8-hydroxyquinoline (8-HQ) was incorporated into UiO-66 (denoted as 8-HQ@UiO-66), and then dispersed in silicone oil at different concentrations to fabricate nanoparticles-enhanced-SLIPSs with improved corrosion resistance and self-healing properties. Especially, when the concentration was 1 mg mL^{-1}, the synergistic interaction of 8-HQ and UiO-66 resulted in outstanding anti-corrosion properties. This was demonstrated by the lowest corrosion current density of 1.24×10^{-10} A cm^{-2} and the highest impedance modulus of 9.88×10^{8} Ω cm^{2} at 0.01 Hz. Furthermore, self-healing performances were assessed using scanning vibration electrode technique (SVET) in combination with electrochemical behaviors of scratched samples, suggesting the superior active corrosion protection of the as-developed SLIPS. This was primarily attributed to the synergistic effects of fluidity of silicone oil, ability to capture Cl^{-} ions of Mg-Al LDH, and exceptional corrosion inhibition of 8-HQ. Hence, the nanoparticles-enhanced-SLIPSs demonstrate considerable potential for practical application in corrosion protection of Mg alloys.

Keywords: Magnesium alloy, Surface treatment, Surface hydrophobicity, Self-healing

CSM7

Curriculum Vitae

PERSONAL DATA

Name in Full Wenhui Yao

Address College of Materials Science and Engineering,
Chongqing University, Chongqing 400044, China

Phone Business
Mobile +86-19823476117
Fax.
Email yaowh2012@cqu.edu.cn

EDUCATION

Bachelor, College of Mechanical and Electrical Engineering, China University of Petroleum
Master, College of Materials Science and Engineering, Beihang University
Ph.D, College of Materials Science and Engineering, Pusan National University

PROFESSIONAL EXPERIENCE

2022.09– present : Associate Professor, College of Materials Science and Engineering, Chongqing University
2019.10 –2022.08 : Assistant Professor, College of Materials Science and Engineering, Chongqing University

RECENT RELATED PUBLICATIONS

1) Jie Qin, **Wenhui Yao**, Liang Wu, Young-Rae Cho, Fusheng Pan, Slippery liquid-infused porous surfaces containing UiO-66 incorporated with 8-hydroxyquinoline for excellent corrosion protection of AZ31 Mg alloys, ACS Applied Materials & Interfaces 16 (2024) 61071-61082.
2) **Wenhui Yao**, Jie Qin, Yonghua Chen, Liang Wu, Bin Jiang, Fusheng Pan, SiO2 nanoparticles-containing slippery-liquid infused porous surface for corrosion and wear resistance of AZ31 Mg alloy, Materials & Design 227 (2023) 111721.
3) **Wenhui Yao**, Guoxiang Zhan, Yonghua Chen, Jie Qin, Liang Wu, Yanning Chen, Jiahao Wu, Bin Jiang, Andrej Atrens, Fusheng Pan, Influence of pH on the corrosion resistance of a slippery liquid-infused porous surface on magnesium alloy, Transactions of Nonferrous Metals Society of China 33 (2023) 3309-3318.
4) **Wenhui Yao**, Yi Tan, Qingze Lu, Hongquan Yi, Changxi Cheng, Liang Wu, Viswanathan S. Saji, Fusheng Pan, Recent advances in protective coatings and surface modifications for corrosion protection of Mg alloys, Journal of Materials Research and Technology 31 (2024) 3238-3254.
5) **Wenhui Yao**, Liang Wu, Bin Jiang, Fusheng Pan, Slippery liquid-infused porous surface by ZnAl-layered double hydroxide on AZ31 Mg alloys, Journal of the Taiwan Institute of Chemical Engineers 150 (2023) 105017.
6) **Wenhui Yao**, Liang Wu, Jingfeng Wang, Bin Jiang, Dingfei Zhang, Maria Serdechnova, Tatsiana Shulha, Carsten Blawert, Mikhail L. Zheludkevich, Fusheng Pan, Micro-arc oxidation of magnesium alloys: A review, Journal of Materials Science and Technology 118 (2022) 158-180.
7) **Wenhui Yao**, Yonghua Chen, Yanning Chen, Liang Wu, Bin Jiang, Fusheng Pan, Development of slippery liquid-infused porous surface on AZ31 Mg alloys for corrosion protection, Acta Metallurgica Sinica (English Letters) 36 (2023) 229-236.

KIM1

A new technology for determining plastic anisotropy in structural materials

Kyeongjae Jeong[1], Heung Nam Han[2]

[1]Sungkyunkwan University, School of Advanced Materials Science and Engineering, Suwon 16419, Republic of Korea, k.jeong@skku.edu

[2]Seoul National University, Department of Materials Science and Engineering, Seoul 08826, Republic of Korea, hnhan@snu.ac.kr

Abstract

Plastic anisotropy plays a critical role in the mechanical behavior and formability of structural materials, making its accurate characterization essential for engineering applications. Conventional uniaxial tensile tests are destructive and costly, limiting their practicality for material evaluation. To overcome these challenges, we propose a novel, non-destructive approach to determining the anisotropic plastic properties of materials using an instrumented indentation technique combined with an advanced data-driven framework. Our methodology leverages finite element simulations of spherical indentation to generate a comprehensive dataset. A neural network-based inverse model is then trained on this dataset to predict the plastic anisotropy of materials, including yield stresses and Lankford coefficients at different orientations relative to the rolling direction. The model utilizes indentation-derived in-plane and out-of-plane displacement fields, as well as load-depth curves, as key input features. Experimental validation demonstrates that the proposed technology accurately reconstructs anisotropic plastic flow characteristics, with predicted stress-strain responses closely matching those obtained from conventional uniaxial tensile tests. This approach provides a robust, efficient, and non-destructive alternative for assessing plastic anisotropy, paving the way for its widespread application in material characterization and structural integrity assessment.

Keywords: Neural networks; Spherical indentation; Finite element analysis; Plastic anisotropy; Strain field

KIM1

Curriculum Vitae

PERSONAL DATA

Name in Full Kyeongjae Jeong

Address Sungkyunkwan University, 2066 Seobu-ro, Jangan-gu,
Suwon-si, Gyeonggi-do, Republic of Korea

Mobile +82-10-6684-2124
Email k.jeong@skku.edu
Homepage https://sites.google.com/view/kj-midlab

EDUCATION

2017. 2: B.S., Department of Materials Science & Engineering, Seoul National University

2022. 8: Ph.D., Department of Materials Science & Engineering, Seoul National University
(Supervisor: Prof. Heung Nam Han)

PROFESSIONAL EXPERIENCE

2022. 9 – 2023. 4: Postdoctoral Research Associate, Research Institute of Advanced Materials, Seoul National University

2023. 5 – 2025. 2: Postdoctoral Research Associate, Department of Microstructure Physics and Alloy Design, Max Planck Institute for Sustainable Materials, Germany

2025. 3 – Present: Assistant Professor, School of Advanced Materials Science and Engineering, Sungkyunkwan University

RECENT RELATED PUBLICATIONS

1) K. Jeong, H. Lee, O. M. Kwon, J. Jung, D. Kwon, H. N. Han, Prediction of uniaxial tensile flow using finite element-based indentation and optimized artificial neural networks, Materials & Design, 196, 109104 (2020)
2) K. Jeong, K. Lee, S. Lee, S.-G. Kang, J. Jung, H. Lee, N. Kwak, D. Kwon, H. N. Han, Deep learning-based indentation plastometry in anisotropic materials, International Journal of Plasticity, 157, 103403 (2022)
3) K. Jeong, K. Lee, D. Kwon, M.-G. Lee, H. N. Han, Parameter determination of anisotropic yield function using neural network-based indentation plastometry, International Journal of Mechanical Sciences, 263, 108776 (2024)

KIM2

Springback of high strength steels predicted by finite element simulations using self-consistent polycrystal model

Youngung Jeong[1,*], Bohye Jeon[1], Jaeseong Lee[1]

[1]School of Materials Science and Engineering, Changwon National University, Changwondaehak-ro 20, Changwon, Gyeongnam, Republic of Korea,
yjeong@changwon.ac.kr

Abstract

An elasto-visco-plastic self-consistent model (ΔEVPSC) has been employed to predict the springback of dual-phase 980 steel subjected to U-draw bending, which corresponds to a benchmark problem, widely known as the Numisheet '93 benchmark. The user material subroutine (UMAT) of ΔEVPSC polycrystal model was utilized with a commercial finite element (FE) solver, Abaqus/standard. The electron back-scattered diffraction (EBSD) scan was performed to obtain the separate crystallographic textures of ferritic and martensitic phases from the as-received sample. Despite the simplicity of the employed hardening model, various complex features of the flow stress behavior, including the Bauschinger effect and non-linearity in elastic loading and unloading, have been accurately captured by ΔEVPSC polycrystal model. With accurately describing the stress relaxation, the FE-predicted springback was in excellent agreement with experiment.

Keywords: Dual-phase steel, anisotropy, forming, springback, texture

KIM2

Curriculum Vitae

PERSONAL DATA

Name in Full Youngung Jeong

Address Changwon National University
20 Changwondaehak-ro, Changwon
51140, Republic of Korea
Phone Business +82-55-213-3694 (Republic of Korea)
Mobile +82-10-4073-3022
Fax. +82-55-261-7017
Email yjeong@changwon.ac.kr

EDUCATION

2008. 2: BS, Dept. of Materials Science & Engineering, Hanyang University
2010. 2: MS, Graduate Institute of Ferrous Technology, POSTECH
2014. 2: PhD, Graduate Institute of Ferrous Technology, POSTECH

PROFESSIONAL EXPERIENCE

2014.3 – 2016.2 : Postdoc, National Institute of Standards and Technology, USA
2016.3 – 2016.11: Research Scientist, Clemson University, USA
2016.12 – 2017.2 : Postdoc, Graduate Institute of Ferrous Technology, POSTECH
2017.3 – present: Assistant, associate professor, Changwon National University
2022.2 – 2024.2 Guest Scientist (offsite), Los Alamos National Laboratory
2024.7 – 2024.8 Short-term visitor, Los Alamos National Laboratory

RECENT RELATED PUBLICATIONS

1) B. Jeon, S.-Y. Lee, J. Lee, Y. Jeong*, Direct application of elasto-visco-plastic self-consistent crystal plasticity model to U-draw bending and springback of dual-phase high strength steel, (2024), International Journal of Plasticity, 181, 104098.
2) B. Jeong, Y. Jeong*, C. N. Tomé, A critical discussion of elasto-visco-plastic self-consistent (EVPSC) models, (2024), Journal of Materials Research and Technology, 33, 7596-7609
3) G. R. Peterson, Y. Jeong, C. N. Tomé, M. D. Sangid*, Cermet design through modeling the thermal cyclic stability via a temperature-dependent, incremental elasto-viscoplastic, self-consistent (TE-VPSC) formulation, (2024), International Journal of Plasticity, 179, 104032
4) Y. Jeong*, C. N. Tomé, (2024) Thermal Ratcheting of uranium simulated by a thermo-elasto-visco-plastic self-consistent polycrystal model, (2024), Journal of Nuclear Materials, 597, 155159
5) J. Lee, D. Steglich, Y. Jeong*, Crystal plasticity finite element simulations on extruded Mg-10Gd rod with texture gradient, (2024), Journal of Magnesium and Alloys, 12, 3409-3430.
6) M. Joo, M.-S. Wi, S.-Y. Yoon, S.-Y. Lee, F. Barlat, C. N. Tomé, B. Jeon, Y. Jeong*, A crystal plasticity finite element analysis on the effect of prestrain on springback, (2023), International Journal of Mechanical Sciences, 237, 107796
7) Y. Jeong*, B. Jeon, C. N. Tomé, Finite element analysis using an incremental elasto-visco-plastic self-consistent polycrystal model: FE simulations on Zr and low-carbon steel subjected to bending, stress-relaxation, and unloading, (2021), International Journal of Plasticity, 147, 103110
8) Y. Jeong*, C. N. Tomé, An efficient elasto-visco-plastic self-consistent formulation: Application to steel subjected to loading path change (2020), International Journal of Plasticity, 135, 102812

KIM3

Effects of User-Defined Parameters on Cluster Analysis in Al-Mg-Si Alloys

MiYoung Lee[1,2,3], Sara Song[1], JiWook Park[1,4], Dieter Isheim[5],

David N Seidman[5], Seok-Jae Lee[2], JaeHwang Kim*[1,3,4]

[1]Korea Institute of Industrial Technology, 222, Palbok-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, 54853, Republic of Korea

[2]Materials and Metallurgical Engineering, Jeonbuk National University, Jeonju-si, 54896, Republic of Korea

[3]Korea Institute of Science and Technology, 92, Chudong-ro, Bongdong-eup, Wanju-gun, Jeollabuk-do, 55324, Republic of Korea

[4]University of Science & Technology, 222, Palbok-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, 54853, Republic of Korea

[5]Northwestern University, Evanston, IL, 60208, USA

raykim@kitech.re.kr

Abstract :

Nanocluster formed during low temperature aging affects the age-hardening behavior in aluminum alloys. This study investigates the cluster analysis of Al-Mg-Si alloys using atom probe tomography (APT).The parameters such as D_{max} and N_{min} can be derived from random labelling process (RLP). The parameters were highly affected by the researcher. There was limitation in detecting cluster in the case of fixed parameter. On the other hand, the parameters set by RLP accurately reflected the atomic arrangement inside cluster. The normalization was applied to clarify the effect of microalloying elements on the chemical composition of the cluster. Detail of cluster analysis will be introduced.

Key Words : *Nanocluster, Age-hardening, Atom Probe Tomography*

KIM3

Curriculum Vitae

PERSONAL DATA

Name in Full	JaeHwang Kim
Address	Korea Institute of Industrial Technology, 222, Palbok-ro, Deokjin-gu, Jeonju-City, 54853, South Korea
Phone Business	+82-63-210-3715 (Korea)
Mobile	+82-10-2496-7096
Fax.	+82-63-210-3715
Email	raykim@kitech.re.kr

EDUCATION

2008. 8: Bachelor, Dept. of Metallurgy Engineering, Chonbuk University

2010. 10: Master, Dept. of Metallurgy and Ceramics Science & Engineering, Tokyo Institute of Technology

2012. 10: PhD, Dept. of Metallurgy and Ceramics Science & Engineering, Tokyo Institute of Technology

PROFESSIONAL EXPERIENCE

2012.10– 2014.12 : Principal Researcher, Hyundai Motor Group

2014.12 – present : Principal Researcher, Korea Institute of Industrial Technology

RECENT RELATED PUBLICATIONS

1) I Kim, M Song, J Kim and S Hong, Effect of added Mg on the clustering and two-step aging behavior of Al–Cu alloys, Materials Science & Engineering A, Vol 798, pp 140123, 2020 [Corresponding author]

2) S Kim, M Song, J Lee and J Kim, The nanocluster formation and vacancy behavior of step-quenched Al–Mg–Si alloy and its effect on transition to β phase via advanced methods, Materials Science & Engineering A, Vol 811, pp 141032, 2021 [Corresponding author]

3) M Song and J Kim, Microstructural evolution at the initial stage of two-step aging in an Al-Mg-Si alloy characterized by a three dimensional atom probe, Materials Science & Engineering A, Vol 815, pp 141031, 2021 [Corresponding author].

4) D Kim, J Kim and E Kobayashi, Enhanced mechanical properties of Al–Si–Cu–Mg(-Fe) alloys by a deformation-semisolid extrusion process, Materials Science & Engineering A, Vol 825, pp 141667, 2021 [Corresponding author]

5) S Kwak, J Kim, H Ding, X Xu, R Chen, J Guo and H. Fu, Machine learning prediction of the mechanical properties of γ-TiAl alloys produced using random forest regression model, Journal of Materials Science & Technology, Vol 18, pp 520-530, 2022 [Corresponding author]

KIM4

Enhancement of Hydrogen Delayed Fracture Resistance in High-Strength Hot-Stamped Boron Steel

Hye-Jin Kim[1], Seung-Pill Jung[2], Hee-Gun Shin[2], Seung-Chae Yoon[2], Jae-Yeul Gong[2], Byung-Gill Yoo[2], Dong-Yeul Lee[2]

[1] Environmental Durability Metals Laboratory, Department of Advanced Materials Engineering, Tech. University of Korea, 237, Sangidaehak-ro, Siheung-si, Gyeonggi-do, Republic of Korea
Email: khj020911@tukorea.ac.kr
[2] Research & Development Division, Hyundai Steel Company, 1480 Buckbusaneop-ro, Songak-Eup, Dangjin-Si, Chungnam, 343-823, Republic of Korea

Abstract

A widely adopted hot stamping method is direct hot stamping, in which a blank is heated in a furnace, transferred to a press, and subsequently formed and quenched in a cooled die. This process results in a fully martensitic transformation, significantly increasing the tensile strength of the steel. However, a major drawback of martensitic steels produced through hot stamping is their high susceptibility to hydrogen-induced delayed cracking. This issue arises from the diffusion of hydrogen into the material, which occurs due to surface reactions with the aluminum coating in the furnace atmosphere during heating. Furthermore, hydrogen-assisted cracking becomes a concern when the steel is exposed to corrosive environments during vehicle operation. To mitigate hydrogen-related failures, it is essential to understand the factors influencing hydrogen-induced delayed fractures, such as microstructure, diffusible hydrogen concentration, and stress-strain behavior. In particular, newly developed hot-stamped martensitic steels with an 1800 MPa tensile strength require a thorough investigation of hydrogen behavior to ensure their reliable application in the automotive industry. This study aims to optimize process parameters to improve the resistance of hot-stamped boron steel to hydrogen embrittlement by analyzing hydrogen uptake and desorption characteristics.

This study focuses on the behavior of diffusible hydrogen in aluminum–silicon-coated hot-stamped boron steel during the hot press forming process used in automotive manufacturing. Using thermal desorption spectroscopy (TDS), we analyzed hydrogen absorption and desorption mechanisms during the hot stamping process and the automotive pre-treatment line for aluminized low-carbon steel. The findings indicate that during the hot stamping process, prolonged soaking in the heating furnace under specific dew point conditions during austenitization leads to increased hydrogen absorption in hot-stamped boron steel. TDS analysis further revealed that the activation energy for hydrogen trapping, is related to hydrogen embrittlement. A key factor influencing resistance to hydrogen-induced delayed fracture was identified as the prior austenite grain size. This study highlights the importance of optimizing process parameters to enhance the hydrogen embrittlement resistance of hot-stamped boron steels, providing valuable insights for improving the structural integrity and durability of ultrahigh-strength steel components in automotive applications.

Keywords: Hot stamped boron steel; diffusible hydrogen; hydrogen-induced delayed fracture; application

KIM4

Curriculum Vitae

PERSONAL DATA

Name in Full	Hye-Jin Kim
Address	D205, Department of Advanced Materials Engineering, Tech. University of Korea, 237, Sangidaehak-ro, Siheung-si, Gyeonggi-do, Republic of Korea
Phone Business	+82-31-8041-0587 (Korea)
Mobile	+82-10-41399392
Email	khj020911@tukorea.ac.kr khj020911@snu.ac.kr
Website	https://www.researchgate.net/profile/Hye-Jin-Kim-4

EDUCATION

2008. 3 - 2012. 8: Bachelor, Dept. of Materials Science & Engineering, Sejong University
2012. 8 - 2014. 8: Master, Dept. of Materials Science & Engineering, Yonsei University
2020. 3 - 2024. 2: PhD, Dept. of Materials Science & Engineering, Seoul National University

PROFESSIONAL EXPERIENCE

2014.7 – 2025.2: Senior researcher, Automotive Body Application Engineering Team, Hyundai Steel
2025.3 – present: Assistant professor, Department of Advanced Materials Engineering, Tech University of Korea

RECENT RELATED PUBLICATIONS

1) Park Hyung Kwon, Lee Jin Jong, Yoo Ji Sung, Kang Yong Joon, Seo Kang Myung, Ha Heon Young, Lee Tae Ho, Lee Chang Hoon, Jung Seung Pill, **Kim Hye Jin**, Study on the Hydrogen Embrittlement Characteristics of Ultra-High-Strength Steel Spot Welds, International Journal of Hydrogen energy
2) Hyun Wook Lee, Tak Min Park, **Hye-Jin Kim***, Jeongho Han*, Correlation between pre-strain and hydrogen embrittlement behavior in medium-Mn steel Accepted and in proof, Journal of Materials Science & Technology (2024)
3) Huixing Li, ChangWook Lee*, Jeffrey Venezuela, **Hye-Jin Kim**, Andrej Atrens*, Hydrogen diffusion and hydrogen embrittlement of a 1500 MPa hot-stamped steel 22MnB5 in different austenitizing conditions, Materials Science and Engineering: A 897 (2024) 146349
4) Kye Jeong Park, **Hye-Jin Kim**, Je Youl Kong, Jea Myoung Park, Ji Young Kim, Joo-Sik Hyun, Seung Chae Yoon*, Analysis of Shear Characteristics of Quenchable Boron-Alloyed Steel 22mnb5 During the Hot Mechanical Piercing Process, Metals and Materials International 30 (2024)
5) Dong-Kyu Kim, **Hye-Jin Kim**, Seoyoon Gong, Se-Eun Shin, Seung-Joon Lee*, A comparative study on the wear behavior of dual phase (DP) steel and quenching and partitioning (QP) steel, Tribology International 21 (2024) 109445
6) Jinheung Park, Geonjin Shin, **Hye-Jin Kim**, Kijung Kim, Seung-Chae Yoon, Seok-Su Sohn, Myoung-Gyu Lee*, A continuum scale chemo-mechanical model for multi-trap hydrogen transport in deformed polycrystalline metals, International Journal of Plasticity 173 (2024) 103890
7) **Hye-Jin Kim**, Shin G-J, Park J-H, Myoung-Gyu Lee*, Kijung Kim, Seung-Chae Yoon, Effect of pre-strain on plastic and fracture behavior of hydrogen charged quench and partitioning (Q&P) steel, Acta Mater., 263 (2024) 119524
8) Kyo-Min Kwon, Tak-Min Park, Jeongho Han, **Hye-Jin Kim**, Hidetoshi Fujii, Seung-Joon Lee*, The effect of friction-stir welding in hydrogen embrittlement of Fe-17Mn alloy, Journal of Alloys and Compounds 967, 10 (2023) 171720
9) Ji-Young Kim, Seung-Chae Yoon, **Hye-Jin Kim**, Myoung-Gyu Lee*, Enhanced Hydrogen Delayed Fracture of 1.5 GPa Hot Stamping Steel Sheet with Sheared Surface by Double Punching Method, International Journal of Precision Engineering and Manufacturing 24 (2023) 173-186

KIM5

Advanced Non-Flammable Ca/Y-Containing Magnesium Alloys for Lightweight Structural Applications

Young Min Kim

Lightweight Materials Research Division, Korea Institute of Materials Science, 797 Changwondaero, Seongsan, Changwon, 51508, Korea

ABSTRACT

Magnesium alloys are the lightest structural metallic materials used in commercial applications. Their low density, high specific strength, and excellent damping capacity encourage their application in mobile components such as electronic devices and transportation vehicles, especially in aircraft seat structures. However, low resistance to ignition and corrosion, poor room-temperature formability, and relatively high costs compared to competing metals like steel and aluminum lead end users to regard magnesium alloys as unsafe, unreliable, and expensive. To overcome these fundamental limitations, significant effort has been devoted to developing new alloys and processes. In this context, a series of non-flammable magnesium alloys containing both Ca and Y has been developed at KIMS, which simultaneously improve non-flammability, corrosion resistance, and formability. As a result, it is considered applicable not only to automotive components and electronic devices but also to train bodies and interior parts. To meet the target properties required by specific applications, optimal chemical compositions and process parameters that control the microstructure and texture have been determined. For instance, an Mg-8Al-0.3Zn-0.1Mn-0.3Ca-0.2Y alloy extruded by a low-temperature, low-speed process exhibits a high tensile strength exceeding 420 MPa and low yield asymmetry, making it suitable for aircraft interior components. Moreover, an Mg-1Al-1Zn-0.2Ca-0.2Y alloy sheet subjected to cold rolling and subsequent recrystallization annealing achieves a fine-grained structure with random texture, which leads to excellent room-temperature formability (LDH over 9 mm). Further details on the application-oriented research of these non-flammable magnesium alloys will be presented.

KIM5

Curriculum Vitae

PERSONAL DATA

Young Min Kim, Ph.D.

Lightweight Materials Research Division
KoreaInstitute of Materials Science(KIMS)
797 Changwondaero, Seongsan-gu
Changwon 51508, Rep. of Korea

Tel: (055) 280-3537
Fax: (055) 280-3599
E-mail: ymkim@kims.re.kr

EDUCATION

1) **Ph.D.**, in Materials Science and Engineering, Pohang University of Science & Technology (Feb. 2005), Thesis:*Effect of Acicular Ferrite on Mechanical Properties of Linepipe Steels*, Advisor:Prof. Nack J. Kim
2) **M.S.**, in Materials Science and Engineering, Pohang University of Science & Technology (Feb. 2002), Thesis:*Effect of Microstructures on Strength and Low Temperature Toughness of Hot Rolled ULCB Steels,* Advisor:Prof. NackJ. Kim
3) **B.S.**, in Materials Science and Engineering, Pohang University of Science & Technology (Aug. 2000)

PROFESSIONAL EXPERIENCE

1) 2017.4–Present PrincipalResearcher, Korea Institute of Materials Science
2) 2014.3-Present Professor, Advanced Materials Engineering, University of Science and Technology (UST)
3) 2012.5-2013.6Researcher, Magnesium Innovation Center, Helmholtz-Zentrum Geesthacht, Germany
4) 2006.3–2017.3Senior Researcher, Light Metals Group, KoreaInstitute of Materials Science
5) 2005.2–2006.3Postdoctoral Researcher, Center for Advanced Aerospace Materials, POSTECH
6) 2000.8–2005.2 Graduate Research Fellow, Materials Science and Engineering, POSTECH

KIM6

High cycle fatigue properties of thick plate steel for seashore structure depending on microstructures

Yong-Nam Kwon [1], Hyunsung Choi[1], W.Kim2

[1] Aerospace Materials Center, Korea Institute of Material Science, Changwon, 51508, Korea
Email: kyn1740@kims.re.kr

[2] Hyundai Steel

Abstract

Due to the increasing demand for high-strength steel, there is a growing need to develop thick plate steel with a grade of 60K or higher for use in seashore structures. To improve the mechanical properties of these steels, techniques are required to control microstructures, including grain size, phase type, and phase fraction. Furthermore, analytical techniques for identifying constituent phases are needed for high-strength steels with complex microstructures, such as ferrite, acicular ferrite, upper and lower bainites, etc. Analysis using high-resolution electron microscopy is time-consuming and limited in terms of analysis area. Therefore, this work aims to identify constituent phases and develop practical methods for easy microstructure analysis, which can aid in developing thick plate steel with high strength. Specifically, high-cycle fatigue properties were investigated under three different R ratios and discussed

Keywords: Steel, Plate, High cycle fatigue, Microstructure

KIM6

Curriculum Vitae

PERSONAL DATA

Name in Full	Yong-Nam Kwon
Address	Aerospace Materials Center, Korea Institute of Material Science, Changwon, 51508, Korea
Phone Business	+82-55-280-3375
Mobile	+82-10-3463-0730
Fax.	+82-55-280-3499
Email	kyn1740@kims.re.kr

PIC

EDUCATION

1992.02: Bachelor, Metallurgical Eng., Yonsei Univ.

1994.04: Master, Materials Eng., POSTECH

1999.08: PhD, Materials Eng., POSTECH

PROFESSIONAL EXPERIENCE

RECENT RELATED PUBLICATIONS (5 Representative Publications)

2)

KIM7

Evaluation and modeling of the interfacial heat transfer coefficient between 1500MPa press hardening steel sheet and die surface in hot stamping

Kyungseok Oh[1], Hyunsung Son[1], Honggee Kim[1]

[1] Materials Forming Research Group, POSCO, Incheon, 21985, Republic of Korea
Email: **oks2012@posco.com**

Abstract

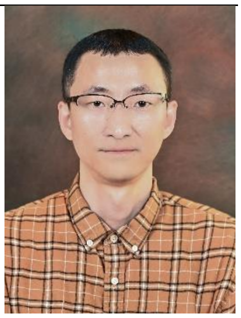
Computer-aided engineering (CAE) analysis on the hot stamping simulation of press-hardening steel (PHS) needs a set of interfacial properties between part and tool such as a heat transfer coefficient (HTC) suitable for commercial software. In general, the simulation input cards consist of solver, history output, contour output, blank model, tool model, boundary condition and interfacial contact setup. The interfacial HTC between part and tool has a direct impact on the temperature distribution and consequently affects the microstructure and mechanical properties of the formed and quenched part. Press hardening steel (PHS) at an elevated temperature 930˚C is Austenite, and which transforms into other phases such as Ferrite, Pearlite, Bainite and Martensite during subsequent thermal histories. The phase transformations during hot stamping strongly depend on cooling speed at each element that is determined by heat transfer from part to nearby tool. Gap between part and tool as one of key factors that influence HTC was investigated. Before considering the "HTC to tool", several factors should be preliminary determined such as heat capacity (HC), thermal conductivity (TC) and "HTC to air", and then the "HTC to tool" is modeled and optimized. A tool having several gaps and contact pressure was designed and applied to experimentally simulate "HTC to air" and "HTC to tool". The tool has six gaps (0.2~1.2mm) and two contact zones where were utilized to evaluate effects of gap and pressure on "HTC to tool" and determine HC, TC and "HTC to air". Thermal cycle for testing the "HTC to tool" at an elevated temperature is divided into three stages: The first step is heating a coupon up to 930˚C and soaking for 75sec for full Austenizing, and the next step is to transfer the coupon on the test tool, and the final step is to cool the coupon until the temperature drops below 200˚C. The temperature profiles obtained in the six zones are used to optimize the "HTC to tool" model parameters. Tensile grade 1500MPa PHS with three different thickness were evaluated. The optimized model parameters were validated by comparing the simulated temperature profiles to experimentally obtained ones.

Keywords: Safety; Hot press forming; Press-hardening steel; Forming; Simulation; Heat transfer

KIM7

Curriculum Vitae

PERSONAL DATA



Name in Full	Kyungseok Oh
Address	210-2801, Songdo Central city The Sharp, 261, Songdogukje-daero, Songdo-dong, Yeonsu-gu, Incheon, Republic of Korea (21986)
Phone Business	+82-32-200-1668 (Korea)
Mobile	+82-10-9193-9087
Fax	+82-32-200-1850
Email	oks2012@posco.com

EDUCATION

2005. 2: Bachelor, Dept. of Mechanical Engineering, POSTECH
2007. 2: Master, Dept. of Mechanical Engineering, POSTECH
2012. 2: Ph.D, Dept. of Mechanical Engineering, POSTECH

PROFESSIONAL EXPERIENCE

2012.2 – present: Researcher, Steel Research Laboratory, POSCO

RECENT RELATED PUBLICATIONS

1) Shin-Yeong Lee*, Seong-Yong Yoon, Jin-Hwan Kim, Frederic Barlat, Kyung-seok, Evaluation of loading-path-dependent constitutive models for springback prediction in martensitic steel forming, International Journal of Mechanical Science 251 (2023) 108-317
2) Kyungseok Oh*, Seok Ryul Lee, Predicting stretched edge fracture of Ultra High Strength Steels with failure strains, Korea Society for Technology of Plasticity and Material Processing, Domestic conference (2022)
3) Jong Won Choi*, Kyungseok Oh, Hong Gee Kim, Dong Jin Kim, Effect of deformation on microcrack depth in hot press formed part with galvanized steel sheet, ISIJ International 59 (2019) 7 1295-1303