

Special Issue for KSTP30 Years Anniversary: Recent Steel Research in Mechanics of Plastic Deformation and Materials Processing

Plastic deformation and related materials processing is the basic technology that produces materials into parts and finished products. Plastic processing is applied to the entire manufacturing process of almost all industries, including automobiles, shipbuilding, aerospace, IT, etc., and is an essential element that determines the quality competitiveness of the final products. Therefore, it is a representative process technology of the root industry that creates new values.

The Korean Society for Technology of Plasticity (KSTP) was founded in 1991. Since its establishment by mechanical and materials researchers in the related fields, KSTP has contributed greatly to the development of Korea's manufacturing industry, especially the automotive, electronics, machinery, and material industries, through academic research and manpower training.

The KSTP is composed of the president, the chief vice president, five vice presidents, and forty-three directors. Transactions of Materials Processing is published six times each year. The KSTP has seven Divisions (Forging, Extrusion, Sheet Forming, Die Manufacturing, Light Weight Materials, Plastics, Rolling) and sponsored NUMISHEET2002, ICTP2008, NUMIFORM2011, NUMISHEET2012, AEPA2018, IDDRG2020 successfully. The KSTP currently has over 2000 members.

The KSTP has four visions:

- Develop an academic organization to connect industry, academia, and research institutions for cooperation,
- Presenting comprehensive and creative solutions to materials processing and leading the creation of new research fields through cooperation in the fields of machinery, materials, and their applications,
- Developed into a global top 4 materials processing academic organization in 45th anniversary,
- Leading the preservation of the global environment through the continuous development of the study and industry of plastic processing in its 60th anniversary.

This special issue includes 25 articles on topical steel research, especially from the International Symposium on KSTP30 Years Anniversary (IS-KSTP30). Although the experimental and numerical methods are generic and can be applied to any material, the constitutive models, i.e., the mathematical descriptions of material behavior, are material specific. The articles include various aspects of steel research, including materials characterization & modeling, anisotropy, formability & fracture, simulation & optimization, innovative process design, phase transformation, machine learning, microstructure, etc. Therefore, understanding both macroscopic and microscopic aspects of the plastic behavior of sheet alloys is essential.

The full titles and links of the papers in this special issue are given as

- Modeling and simulation of steel rolling with microstructure evolution: An overview (<https://doi.org/10.1002/srin.202200260>)
- A critical review on medium-Mn steels: Mechanical properties governed by microstructural morphology (<https://doi.org/10.1002/srin.202200238>)
- Optimization of laser-powder bed fusion processed Fe-4.5Si alloy via response surface methodology (<https://doi.org/10.1002/srin.202200155>)
- Effect of strain localization on the mechanical properties from non-uniform grain size distribution of ultra-low carbon steel (<https://doi.org/10.1002/srin.202200335>)
- Effect of Ti addition on yield strength of Low-Mo Fire-Resistant Steel at elevated temperatures (<https://doi.org/10.1002/srin.202200103>)
- Investigations of formability and dynamic recrystallization development of titanium alloys during dieless wire drawing processes (<https://doi.org/10.1002/srin.202200113>)
- Simultaneous joining and forming of dissimilar steels by electrically assisted pressure joining (<https://doi.org/10.1002/srin.202200256>)
- Effect of strain rate and friction on formability according to major deformation modes in sheet metal forming (<https://doi.org/10.1002/srin.202200255>)
- Microstructural effects on J-integral fracture toughness of welded high-Mn steels at 298 K and 77 K (<https://doi.org/10.1002/srin.202200259>)
- Evaluation of deformation and fracture behavior in 304L austenitic steel harmonic structures through nanoindentation (<https://doi.org/10.1002/srin.202200354>)
- Correlation of microstructure with anisotropy of low-temperature toughness in Two API X70 pipeline steels (<https://doi.org/10.1002/srin.202200479>)
- Supervised machine learning approach for modeling hot deformation behavior of medium carbon steel (<https://doi.org/10.1002/srin.202200188>)
- Optimization of process conditions for ultra-lightweight steel with more than 13 wt.% of Al and 5 wt.% of Cr (<https://doi.org/10.1002/srin.202200207>)
- Creep behavior of Fe-25Ni-15Cr-based alumina-forming austenitic steel (<https://doi.org/10.1002/srin.202200249>)
- Effect of grain size on the pitting corrosion resistance of lean duplex stainless steel (<https://doi.org/10.1002/srin.202200227>)
- Influence of partial replacement of Co with Cu on isothermal transformation kinetics in ferritic/martensitic heat resistant steel (<https://doi.org/10.1002/srin.202200228>)
- Comprehensive assessment of laser tube bending process by Response Surface Methodology (<https://doi.org/10.1002/srin.202200230>)

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- Nano-sized lamellar structures and tensile properties of intercritical-annealed medium Mn steels containing multi-phases (<https://doi.org/10.1002/srin.202200233>)
- Study on surface modification of Fe-Si-Cr alloy by selective oxidation heat treatment and its corrosion properties (<https://doi.org/10.1002/srin.202200236>)
- Synergetic effects of complex additions of Mo and Ni on the phase transformation behavior and mechanical properties of austenitic lightweight steels (<https://doi.org/10.1002/srin.202200251>)
- Effects of Mn segregations on intergranular fracture in a medium-Mn low-density steel (<https://doi.org/10.1002/srin.202200240>)
- Effect of texture and temperature on strain-induced martensitic transformation in 304 austenitic stainless steel (<https://doi.org/10.1002/srin.202200243>)
- Numerical investigation of the galvanic corrosion behavior of a joint between steel and aluminum alloys produced by friction stir joining (<https://doi.org/10.1002/srin.202200242>)

- Effectiveness using low-strength-grade filler wires for 800 MPa grade ultra-high strength steels laser beam welds (<https://doi.org/10.1002/srin.202200248>)
- Experimental and crystal plasticity finite element study of the deformation behavior of high-Mn steel micropillars (<https://doi.org/10.1002/srin.202200254>)

The above articles were peer-reviewed in accordance with the editorial policies of the journal. The Guest Editors are thankful for the co-organizers of the IS-KSTP30 Conference, especially Prof. Man Soo Joun, and sincerely acknowledge Sandra Kalveram (Editor-in-Chief of Steel Research International), who is the driving force and mentor toward the success of this Special Issue during a long journey.

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Heung Nam Han is a professor in the Department of Materials Science and Engineering at Seoul National University, Republic of Korea. He is currently the Director of both the Innovative Process Design Center for Strategic Structural Materials (ERC program) and the Steel Research Center of Research Institute of Advanced Materials (RIAM). He received the Henry Marion Howe Medal from ASM international in 2016. His research interests have been concentrated on Microstructure-based Finite Element Model including Crystal Plasticity, Mechanical Behavior for High Strength Steel, Texture Development of Metals during Electroplasticity, and Electric Current Induced Phenomena in Materials.