

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Discussion Sessions

High Temperature Processes / Process Evaluation and Material Characterization

Lecture No.

Discussion Session	Title	Speaker	Page
Current situations and issues on characterization of multi-component calcium ferrite aiming for production of high-performance iron ore sinters			
13:05-13:45			
D1	Sintering technologies for high quality sintered ore at JFE Steel	T. Higuchi	• • • 399
13:45-14:25			
D2	Reduction behavior of silico-ferrite of calcium and aluminum under blast furnace condition	T. Murakami	• • • 403
14:25-14:40			
D3	withdraw		
14:40-15:20			
D4	Current state of multi-component phase diagram including SFCA phase	R. Murao	• • • 405
15:20-16:00			
D5	Structural study of multi-component calcium ferrite (SFCA) phase	K. Sugiyama	• • • 409

Instrumentation, Control and System Engineering

Lecture No.

Discussion Session	Title	Speaker	Page
Advanced abnormality diagnoses based on area sensing technologies			
9:20-9:30			
D6	Intelligent abnormality diagnosis for steel works by using adaptive area sensing	H. Tamaki	• • • 412
9:30-10:00			
D7	Remote monitoring of conveyor belt using a mirror-drive active vision	I. Ishii	• • • 413
10:00-10:30			
D8	Small vibration measurement and rotating angle measurement of a conveyer belt using sampling moire camera	M. Fujigaki	• • • 415
10:40-11:10			
D9	Parameter dependent models for health diagnosis of equipments based on state, parameter and input estimation method	T. Asai	• • • 418
11:10-11:40			
D10	Unknown anomaly detection using hidden markov model and area sensing technology	I. Ono	• • • 420

Instrumentation, Control and System Engineering / Processing for Quality Products

Lecture No.

Discussion Session	Title	Speaker	Page
Human-system shared control realizing high efficient and stable rolling			
14:05-14:35			
D11	Theories and characteristics of tandem strip rolling	F. Fujita	• • • 424
14:35-15:05			
D12	On simulator for cold tandem rolling control systems	O. Kaneko	• • • 428
15:05-15:35			
D13	(Invited Lecture) Mazda's vision for cars of the future	T. Tochioka	• • • 432
15:35-16:05			
D14	Taxonomy and examples of shared control	M. Itoh	• • • 436
16:05-16:35			
D15	Issues and prospects of shared control for tandem cold rolling	A. Kitamura	• • • 438

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Processing for Quality Products

Lecture No. Discussion Session	Title	Speaker	Page
Current research and development of width control in hot rolling			
13:05-13:45			
D16	Strip width control technology for hot strip mill	S. Fukushima	· · · 441
13:45-14:25			
D17	The state and issues of width control for hot strip mills	M. Sano	· · · 445
14:35-15:15			
D18	Evaluation for deformed profile of Slab-End due to conditions of rolling and press reduction	Y. Nakamura	· · · 449
15:15-15:55			
D19	(Invited Lecture) Influence of sizing press condition on plan view pattern of sheet bar in hot strip mill	H. Goto	· · · 453
15:55-16:35			
D20	Introduction of recent slab sizing press	T. Kamoshita	· · · 457

Program of the 178th ISIJ Meeting (September 11-13, 2019)

International Organized Sessions

High Temperature Processes

2019/9/11 Room1 (Bldg. for General Education 4th fl. A41)

Contribution of steelmaking technology for the sustainable development in Asia

Session Organizer: S. Kitamura [Tohoku Univ.]

9:30-9:35

Opening Remark: S. Kitamura [Tohoku Univ.]

Chair: S. Ueda [Tohoku Univ.]

9:35-10:00

Int.-1 (Invited Lecture) Experimental study on DRI production by both of composite carbon and gas reduction
Dong-A Univ. ○Y. Kang · S. Song . . . 458

10:00-10:25

Int.-2 New refining technologies for high-purity steel and minimization of steelmaking slag
JFE ○Y. Nakai · N. Kikuchi · Y. Kishimoto . . . 462

10:25-10:50

Int.-3 Solution models applied to estimate thermochemical properties of the CaO-SiO₂-P₂O₅-Fe_xO dephosphorization
slags at 1573K
Kyoto Univ. ○M. Hasegawa · K. Saito · Y. Oshima . . . 466

Chair: N. Saito [Kyushu Univ.]

11:05-11:30

Int.-4 (Invited Lecture) Effect of natural convection on formation and melting of shell around low melting point
additives in steel
IIT Kanpur ○A. K. Singh · A. Arya . . . 470

11:30-11:55

Int.-5 Development of full utilization process of steelmaking slag
Nippon Steel ○T. Harada · M. Sakamoto · S. Kakimoto . . . 474

Chair: M. Hayashi [Tokyo Inst. Tech.]

13:00-13:25

Int.-6 Crystallization behavior of molten slags characterized under alternative current field
Kyushu Univ. ○N. Saito · K. Nakashima . . . 477

13:25-13:50

Int.-7 (Invited Lecture) Control of optimum argon shrouding practice - A water model study
IIT Bombay ○N. N. Viswanathan · N. B. Bharath · G. Kalaivani, JSW S.P. Jayaraj . . . 478

13:50-14:15

Int.-8 (Invited Lecture) The role of an upper slag phase and thermal in-homogeneity in melt on grade intermixing
time in a tundish at constant throughput rate
IIT Kanpur ○D. Mazumdar · S. Chakraborty . . . 482

Chair: S. Kitamura [Tohoku Univ.]

14:30-14:55

Int.-9 (Invited Lecture) Key issues of molten steel initial solidification during the process of casting
Central South Univ. ○W. Wang · P. Lyu . . . 486

14:55-15:20

Int.-10 (Invited Lecture) Calcium cored wire injection for stable casting: An insight into fundamentals and economics
IIT Kharagpur ○G. G. Roy · B. Kumar . . . 489

15:20-15:45

Int.-11 MnS precipitation behavior around MnO-SiO₂ inclusion in Fe-Mn-Si-O-S alloy system at the solid-liquid
equilibrium temperature
Tohoku Univ. ○J. Gamutan · T. Miki · T. Nagasaka . . . 493

15:45-15:50

Closing Remark: S. Kitamura [Tohoku Univ.]

Program of the 178th ISIJ Meeting (September 11-13, 2019)

High Temperature Processes

Lecture No.	Title	Speaker	Page
Plenary Session			
Novel processing			
1	Influence of ultrasonic vibration surface roughness on droplet shape	Y. Tanaka	497
2	Improvement of the performance of quasi-zeolite particles synthesized from fly-ash	T. Kozuka	498
3	Phase separation of slag using aggregation by magnetic field	M. Nagano	499
Electromagnetic processing of materials			
4	Influence of composition on heating and flow in molten V_2O_5 - Na_2O under electromagnetic induction	N. Yoshikawa	500
5	Effect of copper rods' position in circular pipe on liquid tin flow under magnetic field imposition	S. Iimura	501
6	Velocity estimation for concentration boundary layer thickness decrease mechanism analysis under simultaneous imposition of current and magnetic field	G. Xu	502
7	Grain refinement mechanism of solidified structure by ultrasonic vibration under condition of flow suppression	N. Tabayashi	503
Cohesive zone in blast furnace 1			
8	An experimental approach to the softening and melting behavior of acid pellet with low-MgO sinter	M. Sun	504
9	Deformation behavior of a packed bed of softening particles	K. Baba	505
10	Gas clogging evaluation due to ore layer softening by eulerian-lagrangian method	S. Natsui	506
11	Trickle flow analysis considering liquid iron-molten slag-coke triple line by SPH	K. Tonya	507
Cohesive zone in blast furnace 2			
12	Modeling of ash particles behaviors during reaction of cokes	K. Teshima	508
13	Relocation of molten CaO - SiO_2 - Al_2O_3 - FeO droplet on surface of reducing agent	S. Ueda	509
14	Factors affecting static hold up of molten slag in coke-packed bed	Y. Lee	510
Effective utilization of resources 1			
15	(ISIJ Research Promotion Grant) Recycling of phosphorus from steel making slag with microalgae II	Y. Hoshikawa	511
16	Long term dissolution behavior of CaO - SiO_2 - FeO_x glassy phase - $2CaOSiO_2$ coexisting slag in paddy field environment	S. Koizumi	512
17	Effect of moisture content on briquetting formability of steel mill dust	K. Maeda	513
18	The study on re-use technology of valuable metal-containing dust for RHF	Y. Jeong	514
Effective utilization of resources 2			
19	Segregation of reduced fine iron ore in powder particle fluidized bed	K. Fujino	515
20	Reduction mechanism of carbon-iron ore composite prepared using lignite	K. Sato	516
21	Removal of gangue in low-grade iron ore by hydrothermal treatment	Y. Mochizuki	517
22	Separation of phosphorus from Mn ore by selective reduction	X. Gao	518
Thermodynamics			
23	Oxygen partial pressure and basicity dependence on the solubility of CrO_x in CaO - SiO_2 - CrO_x slag at low oxygen partial pressure	C. Kato	519
24	Determination of CrO_x activity in CaO - SiO_2 - CrO_x slag under reducing condition	Z. Li	520
25	The thermodynamic property of B in molten Si-Cu-Sn alloy	T. Mizutani	521
26	Phase relation of Fe-Mn-S and Fe-Cr-S system	Y. Lu	522
Transport phenomena			
27	(ISIJ Research Promotion Grant) In-situ observation of bubble at the molten salt / Sn interface by controlling applied potential	H. Konishi	523
28	Trial for in-situ interface observation of desulfurization reaction in molten pig iron-lime system	H. Esaka	524
29	A kinetic model of mass transfer and chemical reactions at a steel/slag interface under effect of interfacial tensions	P. Ni	525
30	Effects of top and bottom blowing conditions on spitting generation phenomena	S. Sato	526
Converter and electric furnace			
31	Computational fluid dynamics simulation on tapping operation of converter	Y. Higuchi	527
32	Nitrogen pickup during tapping of liquid steel from induction furnace to ladle	A. Okayama	528
33	Effective combined blowing technique with slag splashing	L. Yang	529
34	withdraw		

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Secondary refining

35 (ISIJ Research Promotion Grant) Mass transfer analysis of gas-liquid interface in a gas stirred vessel	H. Arai	• • •	530
36 Investigation on bubble fragmentation and inclusion behavior in a simplified model of RH degasser	T. Yamamoto	• • •	531
37 Examination of control of peeling slag protection layer at MgO-C brick	H. Yano	• • •	532
38 Investigation of the steel ladle refractories for safety lining to avoid the molten steel and slag leaking	S. Takahashi	• • •	533

Reactions and operation estimation of blast furnace

39 withdraw			
40 Prediction of oxygen blast furnace reductants ratio restricted by operating conditions	K. Nakamura	• • •	534
41 Effect of highly reactive burden on blast furnace shaft reaction	Y. Park	• • •	535
42 Non-equilibrium state of boudour reaction	K. Nagata	• • •	536

Raceway in blast furnace

43 Effect of the characteristics of pulverized coal on blast furnace operation	D. Seo	• • •	537
44 Simulation of gas-particle motion around raceway in cold model	S. Taya	• • •	538
45 Raceway formation and coke combustion CFD simulation	J. De Castro	• • •	539

Young engineer session of coke-making 1

46 Inhibitory influence of carbon material on dilatation of coking coal	N. Kawadai	• • •	540
47 Effect of coal particle arrangement on coke strength after carbonization	H. Noma	• • •	541
48 Stress simulation analysis of high strength coke using X-ray CT image	T. Tomono	• • •	542
49 The analysis of coke micro structure using X-CT	M. Kitao	• • •	543

Young engineer session of coke-making 2

50 Development of environmentally-friendly processing technology/Development of ferrocoke technology	H. Fujimoto	• • •	544
51 Ferro-coke production technologies using low-grade raw materials	M. Nagayama	• • •	545
52 Mixing analysis of ferro-coke materials	S. Hiroike	• • •	546

Young engineer session of coke-making 3

53 Stabilization of blast furnace operation by quality improvement of yard coke	S. Aikawa	• • •	547
54 Enhancement of efficiency in hot repair for coke oven battery	R. Urakawa	• • •	548
55 Evaluation of door-opening brick relaying for Nagoya No2 coke oven	D. Minori	• • •	549

Coke

56 Study on the effect of stockline level on coke distribution in CDQ by DEM	Z. Fan	• • •	550
57 Study on the effect of bell angle on coke distribution in CDQ by DEM	Z. Fan	• • •	551
58 Combustion behavior of coke gas in coke oven emission facilities	T. Kawashima	• • •	552

Young engineer session of iron making

59 Improvement of coke ratio at Kashima works	T. Nakamura	• • •	553
60 Technology to control agglomeration characteristics on using fine concentrate ore for sinter process	M. Taniguchi	• • •	554
61 Effect of iron ore properties on pore structure of iron ore sinter	R. Kosugi	• • •	555
62 Improvement of heat recovery efficiency by installation of water-seal cooler	M. Ishikawa	• • •	556

Sintering process 1

63 Methodology for continuous pelletization of carbon-cored, double-layered green pellet	K. Iwase	• • •	557
64 withdraw			
65 Time variation of temperature distribution in sinter beds and its dependence on radial position (1)	K. Taira	• • •	558

Sintering process 2

66 In-situ temperature monitoring of sinter beds at high spatial resolution (3)	K. Taira	• • •	559
67 Effect of oxygen partial pressure on the oxidation behavior of iron bearing materials	D. Maruoka	• • •	560
68 Evaluation of density distribution in sintering bed by X-ray CT	K. Hara	• • •	561
69 Influence of chlorine of fine particulate matters emitted from iron ore sintering process	Z. Ma	• • •	562

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Analysis of sinter

70	Effects of MgO addition and source on formation of acicular silico-ferrite of calcium and aluminum (SFCA) in sinter ore	H. Ochi	• • •	563
71	Effect of 2CaOSiO ₂ addition on microstructures of iron ore sinters	D. Zhou	• • •	564
72	Effect of gangue minerals on strength and texture of fine powder granule	S. Nakamura	• • •	565
73	AE measurement system of iron ore sinter in conjunction with micro Vickers	M. Mizutani	• • •	566

Inclusion

74	In-situ observation model for inclusion removal with bubble floatation by using Antibubble	Y. Hirai	• • •	567
75	Microscopic observation of the interface reaction phase between cermet tool and oxide using three-dimensional atom probe	Y. Hosono	• • •	568
76	A discussion on microstructural differences in the heat affected zones of EH36 shipbuilding steels with Mg and Zr additions	X. Zou	• • •	569
77	Three-dimensional observation of typical inclusions in steel by X-ray micro-CT	Z. Shang	• • •	570

Slag and dust treatment

78	Behavior of slag crystallization in continuously blast furnace slag solidification process	Y. Ta	• • •	571
79	Reduction behavior of EAF slag containing Cr ₂ O ₃ and MnO	H. Fukaya	• • •	572
80	Surface observation of calcium-silicate mineral phases after their dissolution into water	F. Ruan	• • •	573
81	Thermodynamic study for the effect of organic acid addition on elution of glassy phase in steelmaking slag	T. Kawasaki	• • •	574
82	Reaction behavior of ZnFe ₂ O ₄ in a MgCl ₂ -based molten salt	Y. Nishioka	• • •	575

Solidification and structure control

83	Crystallographic orientation before and after the massive-like transformation in Fe-18Cr-Ni alloy	K. Ichida	• • •	576
84	Investigation of composition range for selection of the massive-like transformation in Fe-Cr-Ni alloy	T. Suga	• • •	577
85	Impact of inhomogeneity of nucleus upon δ - γ Massive-like transformation analyzed by phase field modeling	K. Kurotsu	• • •	578
86	Cellular automaton simulation of solidification microstructures for Fe-C alloys considered a peritectic reaction	J. Ogawa	• • •	579
87	Numerical simulation of nonequilibrium solidification without assuming stefan condition	K. Takahashi	• • •	580

Continuous casting and solidification 1

88	Scale ratio and fluid properties for multiple non-dimensional numbers similitude of physical modeling for precise representation of flow phenomena	Y. Tsukaguchi	• • •	581
89	Influence of mold level fluctuation on unevenness of solidified shell deformation in mold	K. Furumai	• • •	582
90	Influence of manganese content on unevenness of initial solidified shell thickness	K. Watanabe	• • •	583
91	Prediction and improvement of inner crack of continuous casting copper ingot	T. Sakamoto	• • •	584

Continuous casting and solidification 2

92	Observation and analysis of segregation in laboratory-scale experiment of Sato mold using medium-carbon steel	J. Ma	• • •	585
93	2-dimension center-line segregation simulation of continuous casting	T. Murao	• • •	586
94	Macro-segregation observation and prediction in sand cast steel	A. Kishimoto	• • •	587
95	(ISIJ Research Promotion Grant) Development technology for prevention of macro-segregation in casting of steel ingot by using insert casting	K. Isobe	• • •	588

Continuous casting and solidification 3

96	withdraw			
97	Effect of CaO substitution with BaO for development of fluorine-free mold fluxes	Z. Wang	• • •	589
98	Carburizing behavior of steel by molten cast iron	Y. Nagashima	• • •	590

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Environmental, Energy and Social Engineering

Lecture No.	Title	Speaker	Page
Plenary Session			
Advanced utilization of by-materials			
99	(ISIJ Research Promotion Grant) Recovery of phosphorus from steelmaking slag	M. Uchikoshi	591
100	Optimization of the high phosphate slag fertilizer (Report of the workshop on the effective application of phosphate in the steelmaking slag 1)	T. Harada	592
101	Trial to utilize phosphate in the steelmaking slag for plant cultivation (Report of the workshop on the effective application of phosphate in the steelmaking slag 2)	J. Wasaki	593
102	Long-term alkali elution from steelmaking slag filled in an open channel into seawater	Y. Matsuda	594
103	Fertilization effect of steelmaking slag granules on growth of nori	M. Takano	595
Eco-process and iron making			
104	Fabrication of iron oxide nanoparticles via submerged photosynthesis and the morphologies under different light sources	L. Zhang	596
105	(ISIJ Research Promotion Grant) Development of low flow rate cooling technology for a mold plate of continuous casting with uni-directional porous copper	K. Yuki	597
106	Thermal and mechanical durability of aluminized iron-based heat storage materials	S. Miura	598
107	Test of direct ironmaking process in the early Kofun period	K. Nishimura	599

Instrumentation, Control and System Engineering

Lecture No.	Title	Speaker	Page
Plenary Session			
Instrumentation 1			
108	Inline evaluation of mechanical properties of steel sheets by electro-magnetic method	H. Yamada	600
109	Statistical evaluation method for material uniformity using ultrasonic scattering	T. Morinaga	601
110	The report on the research group of pipe wall measurements using the circumferential guided waves (11) (Study on the circumferential guided waves EMAT using resonance method)	R. Murayama	602
111	Evaluation of inspection properties for inclusions in steel by X-ray CT and UT	K. Ozaki	603
Instrumentation 2			
112	High-precision temperature measurement of materials in a heating furnace	M. Muramatsu	604
113	Measurement of slag emissions using blast furnace tap hole camera	K. Kuwana	605
114	Neural network model for predicting surface defects of wire rods	I. Son	606
Control and system			
115	Crossbow correction for uniform coating weight control	C. Jee	607
116	Operation guidance on thermal control of blast furnace	Y. Hashimoto	608
117	An optimization for ore yard operation schedules using multi-start greedy algorithm	A. Kumano	609
118	Applying column generation to stack sorting problem in the slab yard	T. Kurokawa	610

Processing for Quality Products

Lecture No.	Title	Speaker	Page
Plenary Session			
Modeling of various phenomena in metal forming and its application 1			
119	Dislocation density base modelling of flow stress during tensile testing with holding/unloading and reloading in high tensile strength steel	N. Ueshima	611
120	Prediction of ductile fracture in upset forging by an ellipsoidal void model	K. Komori	612
121	Comparative simulations of hot deformation behavior under varying thermal-mechanical conditions	Y. Liu	613
Modeling of various phenomena in metal forming and its application 2			
122	Evaluation of cold forge solid phase bonding strength between carbon steel and pure aluminum	H. Nagata	614
123	Experimental verification of simplified identification method of yield function using circumscribing polygon	S. Kodama	615
124	Analysis of draw/re-draw process using Yld91 yield function and non-associated flow rule	A. Yoshimura	616
125	Elastic-plastic FEM analysis of tension leveling with different constitutive models	H. Wang	617

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Reliability evaluation of steel weld 1

126	Construction of microstructural diagram for steel based on crystallography	K. Tsutsui	• • •	618
127	Effect of metal vapor transport on electrode deformation during TIG welding	K. Tanaka	• • •	619
128	Numerical simulation for consumption process of tungsten electrode during TIG welding	M. Tanaka	• • •	620

Reliability evaluation of steel weld 2

129	Evaluation of ratio of lattice defects in multi-pass welds of reduced activation ferritic/martensitic steel F82H using positron annihilation technique	H. Mori	• • •	621
130	Solidification evolution and the cracking susceptibility in weld metal of austenitic stainless steels	K. Kadoi	• • •	622
131	Numerical simulation of effect of microstructure on hydrogen-related cracking of duplex stainless steel weld metal	Y. Mikami	• • •	623

Control technology for free cutting-13

132	Influence of MnS aspect ratio on machinability of free-cutting ferritic stainless steel	M. Tojo	• • •	624
133	(ISIJ Research Promotion Grant) Effect of shot grid diffused layer generated by hot shot peening on surface hot shortness	A. Takemura	• • •	625
134	Cutting characteristic of Co-Cr-Mo alloy	M. Hagino	• • •	626
135	Machinability of inconel material by ball end milling	T. Inoue	• • •	627

The technical session by young engineers of hot rolling 1

136	The combustion control using the calorimeter	R. Shima	• • •	628
137	Reduced of scale loss by optimization of air ratio in the reheating furnace at hot strip mill	S. Harada	• • •	629
138	Reheating temperature reduction by the heat retention cover	T. Ushizawa	• • •	630

The technical session by young engineers of hot rolling 2

139	Actions to improve strip passability in finishing mill	K. Nohgashira	• • •	631
140	Inhibiting thermal elevation of finishing roll chock	T. Sasaki	• • •	632
141	Improvement of strip thickness accuracy in hot strip	A. Okamatsu	• • •	633

Young engineer's latest researches on tubes and pipes II-1

142	Improvement of formability in rotary draw bending for high strength steel tubes	S. Tamura	• • •	634
143	FEM simulation of one-sided rubber bulging test of metal tube	K. Nakahara	• • •	635
144	New cutting method of metal pipes with twist shearing	S. Kyuma	• • •	636

Young engineer's latest researches on tubes and pipes II-2

145	Material modeling using multiaxial tube expansion tests and hole expansion forming simulation of hot-rolled steel sheet	S. Nomura	• • •	637
146	Estimation of creep strain equation of weld metal and HAZ in Mod.9Cr-1Mo steel welded joint	T. Nakamura	• • •	638
147	Fabrication of β titanium alloy microtubes using laser dieless drawing	T. Furushima	• • •	639

Advances in processing of powders and powder metallurgy

148	Contact fatigue properties of sintered and rolled gear applied for Ni-Mo pre-alloy steel powder	Y. Taniguchi	• • •	640
149	The relationship between dimensional accuracy and copper content variation during continuous compaction in iron-based sintered material	S. Unami	• • •	641
150	Fabrication of micro parts by viscous flow processing of Pd metallic glassy particles	N. Yodoshi	• • •	642
151	Effect of preheating under glass transition temperature on green density of ferrous metallic glass powders by viscous flow compaction	T. Kamogawa	• • •	643

Scale and cooling

152	Analysis of factors affecting scale detachment of low carbon steels	D. Kim	• • •	644
153	Effect of non-stoichiometry in $Fe_{1-x}O$ layer on thermal effusivity of oxide scale	R. Endo	• • •	645
154	Boiling heat transfer characteristics of water jet to high-speed moving plate	T. Hirao	• • •	646
155	Development of a computational model for water spray quenching of steel	H. Funagane	• • •	647

Cooling

156	Controllability of the stopping temperature of fast cooling by hot compression testing machine	S. Ding	• • •	648
157	Design of feedforward control system for 3-stage cooling based on simplified temperature distribution model for run out table of hot strip mill	R. Saito	• • •	649
158	The effect of boiling regime on residual stress in steel sheet after spray cooling	S. Yanagi	• • •	650

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Hot rolling

159	Decoupling of effect of inter-roll thrust force on off-centering control based on differential force	K. Yamaguchi	• • •	651
160	Efficiency improvement activity in Keihin	T. Koyama	• • •	652
161	Examination of generation mechanism of Periodically changing telescope	T. Akashi	• • •	653
162	An study on reducing lateral bulging deformation in width direction during hot plate rolling	Y. Jung	• • •	654
163	Development of anti-grain coarsening low alloy steel for carburizing	W. Chiu	• • •	655

Fundamental tribological studies on manufacturing processes

164	Sticking in hot rolled sheet of ferritic stainless steel	Y. Matsubara	• • •	656
165	Development of air atomization supplying method in hot rolling process	T. Inoue	• • •	657
166	Curling of hot rolled sheet due to scale on steel surface	R. Aizawa	• • •	658
167	Shear mode fatigue crack propagation test for casting high carbon HSS roll material	N. Oda	• • •	659
168	Evaluation of surface topology of rolled sheet by oils with different lubricity	Y. Okada	• • •	660

Microstructure and Properties of Materials

Lecture No.

Plenary Session	Title	Speaker		Page
-----------------	-------	---------	--	------

Modeling and simulation 1

169	Simulation of clustering process of solute atoms in BCC-Fe based on first principles calculation	M. Enoki	• • •	661
170	First-principles calculations of solute atoms cluster of N and substitutional elements in α -Fe	T. Uesugi	• • •	662
171	Fe-N potential using FS potential	K. Hyodo	• • •	663
172	Numerical analysis of internal stress in pearlite by molecular dynamics and its comparison with elastic theory	Y. Amemiya	• • •	664

Modeling and simulation 2

173	Thermodynamic assessment and calculations of the Fe-Cr-C phase diagrams	K. Oikawa	• • •	665
174	Calculation of grain boundary segregation for boron and carbon based on thermodynamic analysis of the Fe-B-C ternary system	K. Takahashi	• • •	666
175	Prediction of microstructure development of DP steel by quantitative phase-field method	N. Kiyokane	• • •	667
176	Flow stress by inverse analysis with dynamic recovery and recrystallization model of duplex stainless steel	K. Kim	• • •	668

Plate and machine structural steel

177	withdraw			
178	Effect of primary rolling condition on microstructure and mechanical property of the steels after secondary rolling	R. Sakai	• • •	669
179	Effects of forging temperature and concentrations of alloying elements on austenite grain structures during carburization of case-hardening steel	G. Saito	• • •	670

Phase transformation

180	Modeling of the dynamic transformation above the Ae3 temperature	R. Shiraishi	• • •	671
181	Effect of compressive stress on pearlite transformation in high carbon steel	R. Ueji	• • •	672
182	Recrystallization and improvement of rigidity of super invar cast steel by martensitic reversion	N. Sakaguchi	• • •	673
183	Austenite recrystallization mechanism induced by martensitic reversion in super invar alloy	R. Bao	• • •	674

Aging and precipitation

184	Microstructure formation along the eutectoid type reaction path of δ -Fe \rightarrow γ -Fe+Fe ₂ Ta in Fe-Cr-Ta ternary system	Z. Yuan	• • •	675
185	Effect of cooling rate on dispersion state of hard particles and soft particles in ferritic steel	T. Mizuguchi	• • •	676
186	The effect of alloying elements on the high temperature tempering behaviors of Fe-N martensitic steels	S. Young	• • •	677

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Microstructure formation 1

187	Effect of grain size of austenite on formation of retained austenite of low alloy TRIP steels	H. Hasegawa	• • •	678
188	Characteristics of ferrite and the effect on the mechanical properties of cold rolled high strength steel with composite microstructure	T. Nakagaito	• • •	679
189	Comparison of carbon content in retained austenite and martensite by combination of FE-EPMA and EBSD techniques	Y. Tanaka	• • •	680
190	Microstructure observation of martensite in quenched medium-carbon low-alloy steel	T. Niho	• • •	681

Microstructure formation 2

191	The effect of holding conditions after deformation on the transformation texture change of hot deformation material	Y. Takeuchi	• • •	682
192	Visual analysis of local strain distribution with marker method for cold-rolled steel sheet	R. Kurosaka	• • •	683
193	Heterogeneous nano-structures in stainless steels developed by heavy cold rolling and mechanical properties	H. Miura	• • •	684

Hydrogen embrittlement 1

194	Standardization of mechanical testing in high-pressure hydrogen environment with a hollow specimen	T. Ogata	• • •	685
195	Evaluation on the interaction between SUS304 steel and hydrogen gas by using hollow specimens	S. Kumagai	• • •	686
196	A quantum chemical approach to hydrogen embrittleness	S. Kumagai	• • •	687

Hydrogen embrittlement 2

197	Hydrogen embrittlement fracture behavior of a Ni-based superalloy 718 under internal and external hydrogen environments	Y. Ogawa	• • •	688
198	Behavior of hydrogen in a SUS430J1L steel	T. Okazaki	• • •	689
199	Effect of microstructure on hydrogen embrittlement of high strength Fe-Ni-Al-C Alloy	G. Amou	• • •	690

Hydrogen embrittlement 3

200	Strain dependence of lattice defect formation enhanced by hydrogen in pure iron	Y. Sugiyama	• • •	691
201	Local analysis near hydrogen embrittlement fracture surfaces of pipeline steel X80 with stress concentration	T. Homma	• • •	692
202	Reduction of hydrogen embrittlement susceptibility in high strength steels through precipitated VC	K. Hokazono	• • •	693
203	Hydrogen trapping states and hydrogen embrittlement susceptibility of high strength weld metal	R. Inoue	• • •	694

Hydrogen embrittlement 4

204	Crack initiation and propagation analysis in hydrogen induced cracking of tempered martensitic steel	T. Chiba	• • •	695
205	Lattice defect analysis near the initiation / propagation of hydrogen-induced cracking in tempered martensitic steel	T. Chiba	• • •	696
206	Comparison of hydrogen desorption spectra and substructure of tempered martensitic steel applied to cyclic stress with/without hydrogen	M. Ohori	• • •	697
207	Reduction in delayed fracture susceptibility of tempered martensitic steel	S. Hagiwara	• • •	698

Hydrogen embrittlement 5

208	Comparison of fracture morphologies obtained by different methods of evaluating hydrogen embrittlement of multi-phase high strength steels	D. Asari	• • •	699
209	Effects of test conditions on interactions between hydrogen and plastic deformation of high strength multi-phase steel sheet	K. Yashima	• • •	700
210	Effect of pre-strain on the hydrogen embrittlement property in a TRIP-aided bainitic ferrite steel	B. Kumai	• • •	701
211	Evaluation of hydrogen embrittlement of tempered martensitic steel by using U-bending	Y. Shibayama	• • •	702

Stainless steels 1

212	Estimation of Young's modulus by the direct averaging method in isotropic polycrystalline austenitic steel	S. Takaki	• • •	703
213	Effect of Young's modulus in single crystal on the elastic stiffness of austenitic steel	S. Takaki	• • •	704
214	Age hardening behavior at low temperature in high-nitrogen austenitic stainless steel	K. Naridomi	• • •	705
215	Influence of amount of austenite on tensile behavior for martensitic precipitation hardening stainless steels	R. Teko	• • •	706

Stainless steels 2

216	Effect of applied stress on pitting corrosion at sulfide inclusions on Type 304	S. Tokuda	• • •	707
217	(ISIJ Research Promotion Grant) Application of stainless steels for alkaline water splitting electrodes	N. Todoroki	• • •	708
218	Effect of Nickel and Nitrogen on pitting initiation of lean duplex stainless steel on heat affected zone	Y. Yonenaga	• • •	709

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Stainless steels 3

219	In-situ observation of the wetting process on stainless steel surface in atmosphere blazing	A. Kawano	• • •	710
220	Surface film analysis and Cr vaporization property of bright annealed Al added 18%Cr stainless steel	M. Sugeoi	• • •	711
221	Increase of Si content in 20Cr-5Al ferritic stainless steel by siliconizing process	A. Mizutani	• • •	712
222	Effect of Ni addition on ductile-to-brittle transition temperature in 11Cr ferritic stainless steels	K. Inoue	• • •	713
223	The relationship between intermetallic compounds precipitation and concentration profile of Cr in short-time aged duplex stainless steels	N. Nishizawa	• • •	714

Strength and deformation behavior 1

224	Effects of C and N on Hall-Petch coefficient of austenitic stainless steel	Y. Oka	• • •	715
225	Temperature dependence of grain refinement strengthening in SUS316L stainless steel	K. Tsugumi	• • •	716
226	(ISIJ Research Promotion Grant) Low temperature tensile properties in aged ultra-low carbon ferritic steel	N. Koga	• • •	717
227	Relationship between dislocation density and elastic limit in 0.3mass%-carbon martensitic steel	Y. Suzuki	• • •	718

Strength and deformation behavior 2

228	An evaluation on strain rate sensitivity under mode I deformation in energy absorption characteristic of thin specimens made of SUS304	S. Yoshida	• • •	719
229	An evaluation of energy absorption in SUS304 by small punch test at 2 kinds of deflection rate	Q. Chen	• • •	720
230	(ISIJ Research Promotion Grant) An evaluation on rate sensitivity of axial strength of joints using Fe-28Mn-6Si-5Cr shape memory alloy	T. Iwamoto	• • •	721
231	Effect of high nitrogen austenite on tensile properties of nitrogen steel	K. Kikuchi	• • •	722

Strength and deformation behavior 3

232	Understanding serration behavior in high-Mn austenitic steel from a view point of work hardening and plastic deformation	S. Hwang	• • •	723
233	A finite element analysis on anomalous deformation behaviour in thin specimen made of SUS304 by considering dynamic strain aging	Y. Nishigaki	• • •	724
234	An observation of anomalous deformation behavior during quasi-static tensile test in sheet specimen made of SUS304	D. Tamura	• • •	725

Strength and deformation behavior 4

235	Analysis of heterogeneous deformation behavior in austenitic stainless steel using high resolution digital image correlation method	S. Takahashi	• • •	726
236	Hybrid analysis of deformation behavior of austenitic stainless steel	H. Yamada	• • •	727
237	Effect of cementite morphology on local deformability in C-Mn eutectoid steels	T. Nagasako	• • •	728

Strength and deformation behavior 5

238	Prediction of hole expansion ratio for various steel sheets based on uniaxial tensile properties	J. Kim	• • •	729
239	Inhomogeneous deformation behavior of multi-phase steel subjected to tensile and compression periodic test	T. Morikawa	• • •	730
240	A study on compressive deformation and shape recovery behavior of Fe-28Mn-6Si-5Cr shape memory alloy under cyclic thermo-mechanical loading	Q. Sun	• • •	731
241	Cyclic tension-compression test for 590 MPa dual phase steel and its constitutive model	H. Nakamoto	• • •	732

Electrical steel 1

242	Nitriding in strain release annealing	Y. Natori	• • •	733
243	EBSD observation of pure iron with cube texture	D. Okai	• • •	734
244	TEM observation of $\{411\}$ $\langle 148 \rangle$ recrystallization behavior from α -fiber deformed grain in Fe-3%Si alloy	M. Yasuda	• • •	735

Electrical steel 2

245	Influence of lubrication conditions on rolling texture in 3%Si steel	Y. Shimoyama	• • •	736
246	Effect of cutting methods on cut-edge magnetic domain structures of 3% silicon steel	J. Hong	• • •	737
247	(ISIJ Research Promotion Grant) Magnetic properties of non-oriented steel sheet under in-plane isotropic stress applied by piezoelectric element	S. Hashi	• • •	738
248	(ISIJ Research Promotion Grant) Magnetic property analysis of over flux line in transformers	S. Ishikawa	• • •	739

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Recrystallization and grain growth 1

249	Solubility of In in austenite and influence of In on grain growth	J. Nakamura	• • •	740
250	Recrystallization behavior of IF steel at the interface of Al junction	K. Okuda	• • •	741
251	Relationship between three-dimensional microstructure and Avrami exponent for recrystallization in pure iron	T. Ogawa	• • •	742
252	Effect of MnS particle on grain growth of ferrite	M. Seki	• • •	743

Recrystallization and grain growth 2

253	Texture development of cold-rolled and annealed magnetostrictive Fe-Ga alloy	Y. Hayakawa	• • •	744
254	Effects of Nb-addition and initial microstructures on microstructural evolution during annealing in low-carbon steel sheets	H. Dannoshita	• • •	745
255	Abnormal grain growth in Nb-added case hardening steel during high temperature carburization	R. Tsuji	• • •	746
256	In-situ observation of abnormal grain growth of austenite of case hardening steel	Y. Imanami	• • •	747

Ferritic heat resistant steel 1

257	Influence of creep deformation behavior on creep life and rupture ductility of W-Mo-balanced 9Cr steel	F. Abe	• • •	748
258	Non-destructive evaluation of segregation in ferritic creep resistant steel	K. Kimura	• • •	749
259	Influence of segregation on creep strength of ASME Grade T91 steels	K. Kimura	• • •	750
260	(ISIJ Research Promotion Grant) Microstructure evolution of a high boron 9%Cr heat resistant steels crept at 650 and 700 degree-C	N. Sekido	• • •	751

Ferritic heat resistant steel 2

261	Interface failure assessment of dissimilar welded joints by circular notch specimen	H. Yamashita	• • •	752
262	High temperature oxidation suppression mechanism in high nitrogen 9%Cr ferritic heat resistant steels	Y. Tonoe	• • •	753
263	Development of low thermal-expansion and high creep-resistance ferritic heat resistant steels -Effects of alloying elements on thermal expansion of ferritic iron-	H. Fukunishi	• • •	754
264	Creep rate estimation of 2.25Cr-1Mo steel by precipitates distribution analysis	H. Hayakawa	• • •	755

Austenitic heat resistant steel and heat resistant alloy

265	Effect of Phosphorus and Niobium addition on creep strength of wrought Ni-based super alloy	Y. Hasebe	• • •	756
266	Creep behavior of Ta added novel austenitic laves steels at 1073K	Y. Mitsuya	• • •	757
267	Grain size dependence of creep in austenitic single phase steel	H. Wakabayashi	• • •	758
268	Reproducing experimental study by computational study about TCP phase and GCP phase precipitation behavior in Fe-Cr-Ni-Nb austenitic heat-resistant steels	K. Kikuchi	• • •	759
269	Phase equilibria among Al/TCP/ <i>oP</i> in Ni-Cr-Mo ternary system at 973 K	R. Nagashima	• • •	760

Fatigue property

270	10 ¹¹ -cycle gigacycle fatigue tests on high-strength steel	Y. Furuya	• • •	761
271	Giga-cycle fatigue properties of A5083P-O and A7075-T5 aluminum alloys	H. Hirukawa	• • •	762
272	Investigation of fracture process in rotational bending fatigue test of soft nitrided JIS SCM420 steel	N. Ihara	• • •	763
273	Fatigue life characteristics for low carbon steel with simulated HAZ heat treatments	H. Nishikawa	• • •	764

Toughness and ductility

274	Dependency of CTOD toughness on cementite cracking and its modeling in martensitic steels	T. Namegawa	• • •	765
275	Effects of Cr addition on the low temperature toughness in high manganese austenitic steels	D. Izumi	• • •	766
276	(ISIJ Research Promotion Grant) Evaluation of fracture toughness affected by micro voids in ductile to brittle transition	T. Kagimura	• • •	767
277	Effect of wire drawing on crack formation in tensile deformation of pearlite steel	T. Teshima	• • •	768

Hot-dip coating

278	Hardness and compressive deformation property of Fe-Zn solid-solution	A. Sengoku	• • •	769
279	Correlation of interfacial microstructure with adhesive bonding in galvanized interstitial-free steel sheets	H. Park	• • •	770
280	Research on the crater degeneration process of galvanized interstitial-free steel sheets	Y. Jeong	• • •	771
281	Effect of Al content on plastic deformability of hot-dip Zn-Al coatings	T. Mitsunobu	• • •	772
282	In-situ SEM observation for fracture behavior of hot-dip Zn-Al-Mg alloy coating on steel sheets by bending deformation	H. Yokoi	• • •	773

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Chemical property

283	Microstructure change of intermetallic compound layer formed in hot-dip Al coated steel	K. Shinozuka	• • •	774
284	(ISIJ Research Promotion Grant) Characterization of dissolution resistance of ferrous materials to molten aluminum alloys using pseudo binary phase diagrams	I. Goto	• • •	775
285	Effect of aggregate in primer on blistering	S. Takaoka	• • •	776
286	Hydrogen generation over porous CeO ₂ supported Ru catalysts and the effect of Fe addition	C. Ueda	• • •	777

Hydrogen embrittlement 6

287	Effect of alloying elements on hydrogen diffusion in iron	T. Omura	• • •	778
288	Interaction between hydrogen and alloying elements in α iron	H. Sawada	• • •	779
289	Calculation model of hydrogen diffusion coefficient in steel	D. Akahoshi	• • •	780
290	Effect of chromium on hydrogen absorption behavior in iron	Y. Vanadia	• • •	781

Hydrogen embrittlement 7

291	Effect of adherent MgCl ₂ amount on hydrogen permeation of iron covered with the rust	Y. Wang	• • •	782
292	Hydrogen entry into steel during rust removal by blast	M. Kawamori	• • •	783
293	(ISIJ Research Promotion Grant) Influence of microscopic damage and hydrogen on tensile-shear strength of clinched joint	D. Sasaki	• • •	784

Hydrogen embrittlement 8

294	Evaluation of hydrogen-related cracking in duplex stainless steel considering microscopic distribution of stress and diffusible hydrogen	Y. Mikami	• • •	785
295	Prediction model for weld hydrogen cracking in high strength steel weld in terms of residual stress and hydrogen diffusion behavior	Y. Sato	• • •	786
296	Pre-heat temperature effect on hydrogen transportation behavior for y-grooved weld joint based on α multiplication method considering the stability condition of numerical analysis	G. Ozeki	• • •	787

Process Evaluation and Material Characterization

Lecture No.

Plenary Session

Title

Speaker

Page

Surface and state analysis

297	Effect of plasma generation method on the surface of SUS316 in plasma nitriding	K. Miura	• • •	788
298	Visualization of Fe chemical state distribution in sintered ore by imaging XAFS	M. Takagaki	• • •	789
299	Phase identification of microstructure of multiphase steel by SEM at extremely low landing energy	T. Aoyama	• • •	790

Crystal structure analysis

300	In-situ observation of phase fraction and carbon diffusion in bainite transformation of Low-Alloyed TRIP steel by neutron diffraction	T. Hirano	• • •	791
301	Movement of ferrite/austenite interface under cooling and distribution of alloying elements	T. Amino	• • •	792
302	Effects of dislocation interactions and dislocation characteristics on work hardening	K. Nakagawa	• • •	793
303	Comparison of dislocation contrast in steel obtained by using SEM-ECCI and TEM	T. Mori	• • •	794

Elemental analysis 1

304	Detection of free magnesia in steelmaking slag after aging process	S. Imashuku	• • •	795
305	Polarized continuous white X-rays produced by linear polarizer made from Li ₂ B ₄ O ₇	R. Tanaka	• • •	796
306	(ISIJ Research Promotion Grant) Fundamental parameter method for ED-XRF	J. Kawai	• • •	797
307	Research on the cohesive property of iron ore fines	W. Pan	• • •	798

Elemental analysis 2

308	(ISIJ Research Promotion Grant) Distribution of alumina inclusion particles in ferritic stainless steels in scanning laser-induced breakdown spectrometry using 1-kHz Q-switched Nd:YAG laser	K. Wagatsuma	• • •	799
309	Application of LIBS to sorting of aluminum materials and detection of the inclusion particles	Y. Fugane	• • •	800
310	Glass bead sample pre-treatment for inductively coupled plasma-atomic emission spectrometric analysis of major components in blast furnace slag	K. Nakayama	• • •	801

Program of the 178th ISIJ Meeting (September 11-13, 2019)

ISIJ and JIM Joint Sessions

Lecture No. Joint Session	Title	Speaker	Page
Titanium and its alloys 1			
J1	Synthesis of TiCl ₄ by low-temperature chlorination of TiN	E. Ahmadi	802
J2	Evaporation behavior of solute elements in Ti-alloy melt	H. Mizukami	803
J3	Effect of reaction rate on state in upper space above bath surface in actual sponge titanium production vessel	Y. Inoue	804
J4	Manufacturing of high quality titanium thin foil of A4 size by electrodeposition route	Y. Nakajo	805
J5	Nanoscale analysis of cross-sectioned microstructure after machining in Ti531C alloy with Cu and Ni addition	T. Furuwara	806
Titanium and its alloys 2			
J6	Rapid oxidation and nitriding of additive manufactured Ti-6Al-4V alloy by induction heating in air	K. Tamura	807
J7	Comparison of pressformability in commercially pure titanium JIS class1 sheet and interstitial free steel sheet	R. Miyoshi	808
J8	Effect of interactions among grains on slip system activation and its range in α Ti	Y. Kawano	809
J9	Effect of Al addition on tensile deformation property of Ti-18Nb-xAl alloys	Y. Mantani	810
J10	Effect of V on mechanical properties and age-hardening behavior of Ti-Mn alloys	Y. Nakamura	811
Titanium and its alloys 3			
J11	Dependence of microstructure on creep behavior and deformation mechanism in near- α Ti alloy	H. Masuyama	812
J12	Constitutive plastic behavior, Dynamic globularization and machine learning of the Ti-6246 alloy under hot forging process	H. Matsumoto	813
J13	Formation of silicide of high-temperature near- α Ti alloys	Y. Yamabe-Mitarai	814
Titanium and its alloys 4			
J14	Effect of interstitial elements on hot deformation behavior and microstructure evolution of Ti-17 alloys	T. Tsukase	815
J15	Dynamic precipitation of alpha phase during deformation in Ti-17 alloy	E. Chandiran	816
J16	Effect of hot multi-directional compression on dynamic recrystallization in Ti-17 alloy	A. Ito	817
J17	Relationship between microstructure and mechanical properties of Ti-17 alloy for aerospace application and machine learning	D. Tadokoro	818
J18	Deformation-static recrystallization behavior of Ti-5553 alloy for aerospace application	M. Yoshimura	819
Ultrafine grained materials -fundamental aspects for ultrafine grained structures- 1			
J19	Relationship between nanostructure and mechanical properties of electrodeposited nanocrystalline nickel	T. Hayashi	820
J20	Effect of low temperature on deformation behaviors of Mg-0.1 at.%Y alloy having various grain sizes	K. Oki	821
J21	Influence of ECAP processing and heat treatment on tensile property and fatigue crack initiation in ZK60A magnesium alloy	K. Umeda	822
Ultrafine grained materials -fundamental aspects for ultrafine grained structures- 2			
J22	Microstructure and mechanical properties of fine-grained Ti-25Nb-25Zr alloy prepared from TiH ₂ mixed elemental powders	B. Sharma	823
J23	Microstructure and mechanical properties of harmonic structure designed CrMnFeCoNi high entropy alloy	N. Togawa	824
J24	Peculiar mechanical properties and its mechanism of harmonic structured pure copper	M. Kawabata	825
Ultrafine grained materials -fundamental aspects for ultrafine grained structures- 3			
J25	Microstructure distribution through radius of pure aluminium rod deformed by surface shear extrusion	N. Kamikawa	826
J26	Effect of stacking fault energy on microstructural evolutions and mechanical properties of FCC metals processed by severe plastic deformation	M. Asano	827
J27	Nano-crystallization of quasi-stabilized austenitic stainless steels by dry ice particle peening	S. Minamimoto	828
Materials science of martensitic and bainitic transformations and its applications 1			
J28	Negative Poisson's ratio in single-crystal Cu-Al-Mn shape memory alloys	S. Xu	829
J29	Kinetic arrest of R-B19' transformation in Ti-(50-x)Ni-xFe shape memory alloy	M. Todai	830

Program of the 178th ISIJ Meeting (September 11-13, 2019)

J30	Synchrotron radiation analysis on controlling mechanism of excellent strength and ductility in low carbon -2Si-5%Mn fresh martensitic steel	T. Fuse	• • •	831
J31	Development of 1500MPa-30% high strength and high ductility 5% Mn ferrite+austenite steels and synchrotron radiation analysis on the mechanism to emerge the excellent mechanical properties	K. Minoda	• • •	832
Materials science of martensitic and bainitic transformations and its applications 2				
J32	Sensitivity coefficients of martensite microstructure to material parameters in steel	Y. Tsukada	• • •	833
J33	Internal stress of hcp-martensite formed in Fe-Cr-Ni alloys	Y. Wada	• • •	834
J34	Analysis of deformation behavior of martensite in a ultra-low carbon steel by crystal plasticity finite element method	S. Nambu	• • •	835
J35	Segregation of boron to austenite grain boundary during cooling after high temperature austenitization	G. Miyamoto	• • •	836
Materials science of martensitic and bainitic transformations and its applications 3				
J36	Effect of thermo-mechanical control process on toughness of medium Mn martensitic steel	S. Okuhata	• • •	837
J37	Martensitic transformation of high-entropy and medium-entropy alloys	H. Matsuda	• • •	838
J38	Effect of the grain boundary a particle on martensite transformation behavior in Fe-Ni-Si alloys	K. Kitamura	• • •	839
J39	Giant elastocaloric effect with wide temperature window in nanocrystalline Ti-44Ni-5Cu-1Al shape memory alloy	F. Xiao	• • •	840
Materials science of martensitic and bainitic transformations and its applications 4				
J40	Effects of peening direction on reverse transformation induced by shot-peening for Fe-Ni alloys	H. Sato	• • •	841
J41	Effect of precipitates on dislocation-reducing rate in tempering treatment	S. Yoshida	• • •	842
J42	The microstructure and mechanical properties of medium-Mn steels treated with interrupted quenching and intercritical annealing	S. Tanaka	• • •	843
J43	Analysis of carbide chemical composition of Si-added middle carbon tempered martensitic steels	T. Suzuki	• • •	844
Materials science of martensitic and bainitic transformations and its applications 5				
J44	Room temperature aging behavior of low-to-medium carbon low alloy ferrous lath martensite	N. Maruyama	• • •	845
J45	In-situ heating TEM study of carbides in low-carbon martensite	Y. Fukuo	• • •	846
J46	Alloying effects on low-temperature tempering behaviors of high-carbon martensite	Y. Zhang	• • •	847
J47	Visualization of hydrogen release from lath martensite transformed from hydrogen-charged austenite	K. Oie	• • •	848
Materials science of martensitic and bainitic transformations and its applications 6				
J48	Effect of tensile stress on the kinetics of isothermal martensitic transformation	W. Mao	• • •	849
J49	Effects of prior austenite grain size on microstructure of bainite and retained austenite in TRIP steel	M. Watanabe	• • •	850
J50	Microstructure and local orientation relationship of lower bainite in carbon steels	T. Hayashi	• • •	851
Materials science of martensitic and bainitic transformations and its applications 7				
J51	Invariant line analysis of experimental martensite orientation relationship	D. Akahoshi	• • •	852
J52	Morphology and crystallography of martensite in equiatomic HfNi alloy	M. Matsuda	• • •	853
J53	Microstructural analysis of lenticular martensites in Fe-Ni-C alloy based on Rank-1 connection	Y. Shinohara	• • •	854
J54	Geometrical models and matrices for fine crystals at crossing hexagonal ϵ variants	T. Sawaguchi	• • •	855
Materials science of martensitic and bainitic transformations and its applications 8				
J55	Magnetic-field-induced martensitic transformation and its in situ observation in Fe-Mn-Ga shape memory alloys	X. Xu	• • •	856
J56	In-situ measurement of surface relief induced by martensitic transformation	J. Inoue	• • •	857
J57	Recrystallization texture control of Ti-4.5Al-3V-2Fe-2Mo alloy	H. Tobe	• • •	858
J58	Characterisation of the martensite blocks in Fe-C low alloy lath martensite	S. Morito	• • •	859
Physico-chemical properties of high temperature melts 1				
J59	Thermophysical property measurements of high temperature oxide melts using an electrostatic levitation furnace onboard the International Space Station - report 3	T. Ishikawa	• • •	860
J60	Excess volume and partial molar volume of Ti-X(X=Cu, Ni) melts	M. Watanabe	• • •	861
J61	Measurement of apparent thermal conductivity of mould flux containing iron oxide by parallel plate method	T. Yamauchi	• • •	862
J62	Examination of sample diameter for thermophysical property measurement of solid sample using surface heating and surface detection laser flash method	K. Mori	• • •	863

Program of the 178th ISIJ Meeting (September 11-13, 2019)

Physico-chemical properties of high temperature melts 2

J63	Interfacial reaction and joining of Bi-Te materials against metallic substrates	S. Sukenaga	• • •	864
J64	Wettability of Y ₂ O ₃ -SiO ₂ composites with different SiO ₂ activities against molten iron-based alloys	Z. Zhang	• • •	865
J65	In-situ observation of the formation process of surface fine crevice structure by high-speed camera under laser-irradiation	J. Yeon	• • •	866
J66	Measurement of speed of super-spread wetting on surface fine crevice structure by laser-irradiation	M. Nakamoto	• • •	867

Physico-chemical properties of high temperature melts 3

J67	Wide-range composition dependence of viscosity of molten SiO ₂ -Na ₂ O-NaF system	O. Takeda	• • •	868
J68	Influence of dispersed bubbles on viscosity behavior of triple phases coexisting slag	Y. Egashira	• • •	869
J69	Thermodynamic properties of Sm-O system for high coercivity magnet material development	R. Nakazawa	• • •	870
J70	Assessment of Cu behavior between Cu-containing multi-component slag and matte using the reaction model and measurement of Cu ₂ O activity coefficient	S. Shin	• • •	871

Physico-chemical properties of high temperature melts 4

J71	Spontaneous colloidal metal cellular convection formation driven by molten salt electrolysis	S. Natsui	• • •	872
J72	Thermal behavior of electrodeposited melt in molten salt electrolysis	R. Shibuya	• • •	873
J73	Identification of solid phase in slag suspension by alternating current impedance method	Y. Takao	• • •	874

Physico-chemical properties of high temperature melts 5

J74	Proposal to determination method of density of oxide scale formed on steel	S. Shinohara	• • •	875
J75	Crystal structure stability of Ca ₂ SiO ₄ -based solid solution predicted by Ab initio calculation	M. Suzuki	• • •	876
J76	In-situ phase identification of crystal precipitated from molten CaO-SiO ₂ -P ₂ O ₅ -FeO slag	H. Serizawa	• • •	877