

The 105th ISIJ Meeting Programme*

S Y M P O S I A

-- IRONMAKING --

APRIL 1, 1983 13:00 - 17:00 Chairman: Reiji Nishida

Theme I. Sinter Qualities Required for Better Blast Furnace Performances and
Sintering Conditions for Their Realization

1 Behaviour of sintered Ores in a Blast Furnace. Kosei Kushima, et al.	A1
2 Properties of sinter suitable for blast furnace operation and conditions of sintering. Kazuo Masuda, et al.	A5
3 Manufacturing practice for high quality sinter. Katsuaki Siobara, et al.	A9
4 Basic factors for ensuring high quality to sintered ore. Yukihiro Hida, et al.	A13
5 Formation process of microstructure of lime-fluxed sinter and its relationship to reduction induced sinter degradation. Katsuhiro Inoue, et al.	A17
6 Investigation of controlling factors of reduction induced degradation index(RDI) in sintering operation. Akira Sasaki, et al.	A21

-- STEELMAKING --

APRIL 2, 1983 13:00 -17:00 Chairman: Toshihiko Emi

Theme II. Development of Ladle Metallurgy

7 Characteristics and limitation of fluxes for dephosphorization and desulfurization of molten steel. Hideaki Suito, et al.	A25
8 Effect of stirring on the kinetics of injection refining processes. Masamichi Sano, et al.	A29
9 Optimization of clean steel production by ladle refining processes. Kenji Takahashi, et al.	A33
10 High rate production of extra clean steels with ladle refining processes. Yukio Oguchi, et al.	A37
11 Production of high purity steels by ladle refining technology. Yoshimasa Mizukami, et al.	A41
12 Production of special steels by LD-AOD process. Yuji Tanaka, et al.	A45
13 Refining characteristic and application of ladle furnace (LF) process. Goro Yuasa, et al.	A49
14 Refining characteristics and application of ASEA-SKF process supplemented by powder injection. Matsuhide Aoki, et al.	A53

-- PLASTIC WORKING AND OTHER FABRICATION PROCESSES --

APRIL 1, 1983 13:00 - 17:00 Chairman: Haruyoshi Nakamura
Vice-chairman: Jinkichi Tanada

Theme III. Development of Welding Technology on Steel Manufacturing Process

15 Application of four-electrode submerged arc welding process to large diameter pipe manufacture. Tadamasa Yamaguchi, et al.	A57
16 Toughness of weld metal in high speed welding on UOE process. Norio Katsumoto, et al.	A61
17 A new production welding process for U-O steel pipes with thick wall. Shigeo Fujimori, et al.	A65
18 Application of large current MIG welding process to UOE pipe production. Kiyoteru Hirabayashi, et al.	A69

* Tetsu-to-Haganè, 69(1983), No. 4 contains S1 to S315 preprints in Japanese of Paper Presentations and Tetsu-to-Haganè, 69(1983), No. 5 does S317 to S711 preprints of them.

The preprints of Symposia were published in Tetsu-to-Haganè, 69(1983), No. 2, A1 to A151, in Japanese.

19 Method for monitoring and automatic controlling of the welding phenomenon in the high-frequency electric resistance welding of medium-size pipes. Hiroyo Haga, et al.	A73
20 New flash butt welding for connecting hot strip. Kiyoshi Ōya, et al.	A77
21 Application of laser welding to sheet steel production. Hiroaki Sasaki, et al.	A81

-- PROPERTIES OF IRON AND STEEL --

APRIL 1, 1983 13:00 - 17:00	Chairman: Ryohei Tanaka
Theme IV. Function of Nitrogen in Stainless and Heat-resisting Steels	
22 Microstructural aspects of nitrogen in austenitic stainless steels. Makoto Kikuchi, et al.	A85
23 Influence of nitrogen on strength of austenitic stainless steel at low temperatures. Toshihiko Takemoto, et al.	A89
24 Cyclic softening of austenitic stainless steels strengthened by nitrogen. Koji Shibata, et al.	A93
25 Effect of nitrogen on the low temperature mechanical properties of Type 304 austenite stainless steel weld metals. Yasushi Kikuchi, et al.	A97
26 Influence of alloying elements on corrosion resistance and mechanical properties of 17%Cr-7%Ni stainless steel. Hiroshi Hiramatsu, et al.	A101
27 Stress corrosion cracking and high temperature strength properties of nitrogen containing stainless steels. Yoshiatsu Sawaragi, et al.	A105

APRIL 2, 1983 13:00 - 17:00	Chairman: Michihiko Nagumo Vice-Chairman: Fukunaga Terasaki
----------------------------------	--

Theme V. Basic Aspects on Hydrogen Embrittlement of Iron and Steel

28 Hydrogen behaviour in steels using tritium. Teruo Asaoka, et al.	A109
29 Relation between hydrogen trapping effect of precipitates and hydrogen embrittlement. Nobuo Totsuka, et al.	A113
30 Relation between hydrogen embrittlement behavior of high strength steel and critical hydrogen content. Koji Yamakawa, et al.	A117
31 Delayed failure under repeating load. Keijiro Nakasa, et al.	A121
32 The meaning of the critical hydrogen content on hydrogen embrittlement of iron. Michihiko Nagumo.	A125
33 Plastic deformation of carbon steel caused by cathodic hydrogen charging. Hideki Hagi, et al.	A128
34 The influence of microstructures on the process of hydrogen stress cracking in low strength steels. Nobuhiro Seki, et al.	A132
35 Hydrogen environment embrittlement of structural steels at the ambient temperature. Hisashi Kaga, et al.	A136
36 Metallurgical factors of intergranular fracture in hydrogen embrittled high strength steels. Hiroyuki Morikawa, et al.	A140
37 Hydrogen assisted grain boundary fracture mechanism of a tempered martensite Steel. Shinsaku Matsuyama.	A144
38 Hydrogen embrittled crack growth in iron single crystal. Shigeharu Hinotani, et al.	A148

P A P E R P R E S E N T A T I O N S

-- IRONMAKING --

APRIL 1, 1983

1 Gas flow analysis in the blast furnace by using finite element method with quadratic elements. Jun-ichi Kudoh, et al.	S1
2 Dynamic simulation of the effect of furnace operation factors on Si content in pig iron. Makoto Namura, et al.	S2
3 Dynamic simulation model of the blast furnace considering the radius distribution of burden. Hideo Kubo, et al.	S3
4 Determination of boundary condition for mathematical model of cohesive zone. (Development of estimating technique for profile of cohesive zone in blast furnace--V). Kunihiro Kondo, et al.	S4
5 Calculation of temperature distribution by mathematical model of cohesive	

zone. (Development of estimating technique for profile of cohesive zone in blast furnace--VI). Kunihiro Kondo, et al.	S5
6 Simulation of the burden flow around the cohesive zone of blast furnace. Keisuke Mio, et al.	S6
7 Development of blast furnace data analysis system. Fumio Noma, et al.	S7
8 Development of furnace diagnosis system. Masaro Izumi, et al.	S8
9 Blast furnace tuyere observation system and some applications in Hirohata Works, Nippon Steel Corporation. Mitsuo Kambe, et al.	S9
10 Reduction and desulfurization of carbon coated iron ore by fluidized bed. (Production of direct reduced iron using petroleum residue--IV). Ryo Watanabe, et al.	S10
11 Prereduction of chromium ore pellet with rotary kiln. Susumu Uoya, et al.	S11
12 Effect of chemical composition of flux and temperature on smelting reduction rate of chromite. (Development of ferrochrome production process by smelting reduction--I). Mitsuo Sumito, et al.	S12
13 Reduction rate of chromium ore with gas containing CH ₄ in a fluidized bed. (Development of ferrochrome production process by smelting reduction--II). Hideshi Katayama, et al.	S13
14 Smelting reduction of chromium ore in a coke bed type micro-reactor. (Development of ferrochrome production process by smelting reduction-III). Hideshi Katayama, et al.	S14
15 Fundamental study on the reduction of chromium ore by powder injection into molten pig iron in a small induction furnace. Hirobumi Yoshiga, et al.	S15
16 Production of complex cold pellet containing carbon and use of it in SiMn production. Hideyuki Yoshikoshi, et al.	S16
17 Induration of briquette with carbonaceous materials. Yoshiro Kimura, et al.	S17
18 Aluminum blast furnace--Direct reduction of bauxite under the pure oxygen blast by an experimental furnace--. Masayuki Dokiya, et al.	S18
19 Measurements on gas concentration change in the initial stage of reduction of metallic oxide pellets at low flow rates. Tateo Usui, et al.	S19
20 Reduction rate of wustite at the elevated temperatures above 1 000 °C. Hirofumi Yamanami, et al.	S20
21 Effect of the oxygen and sulphur potential in reducing gas on the reduction rate of wustite and morphology of reduced iron. Shoji Hayashi, et al.	S21
22 Different types of iron precipitations during reduction--In-situ-observations by a modified scanning electron microscope(SEM)--. H. Christian Schaefer, et al.	S22
23 On the thermal diffusivity of sponge iron and sinter--II. P. Rademacher, et al.	S23
24 Microstructures of iron oxide pellets reduced by carbon in iron melt. (Research on the smelting reduction of iron ore with coal--IV). Akira Sato, et al.	S24
25 Change of nitrogen content of blast furnace slag by water granulation. Yoshikazu Nagao, et al.	S25
26 The hydraulic hardening capacity of LD slag macadam. Aribumi Niida, et al.	S26
27 Mechanical strength of blast furnace slag at high temperature. Hidenobu Kondou, et al.	S27
28 Heat transfer characteristics of working fluid for drum cooling. (Development of heat recovery of blast furnace slag--II). Toyokazu Teramoto, et al.	S28
29 Development of molten blast furnace slag granulator. (Development of heat recovery technology for blast furnace slag--I). Yutaka Ariake, et al.	S29
30 Effect of fine ore addition on the sintering. Takuma Kodama, et al.	S30
31 Operation results of preagglomeration by nuclear ores addition on raw mix. Development of agglomeration of fine-grain material in sintering--II). By Ukio Kobayashi, et al.	S31
32 Grain size effect of screened fine on sinter property. Terutoshi Sawada, et al.	S32
33 Utilization of the slag product in de-sulfurizing process of molten pig iron. Shunji Iyama, et al.	S33
34 Production of low SiO ₂ sinter in Mizushima Works, Kawasaki Steel Corporation. Shunji Iyama, et al.	S34
35 Effect of sized limestone addition on sinter quality. Masami Fujimoto, et al.	S35
36 Improvement of permeability in sintering bed--I. Shunsuke Arino, et al.	S36
37 Characteristics of reduction degradation of sinter. (Unification of sintering heat pattern--III). Kimio Kato, et al.	S37
38 Properties' distribution of sinter bed on the pallet. (Unification of sintering heat pattern--IV). Kimio Kato, et al.	S38
39 A method of coal screening for liquefaction and properties of liquefied coal. Yoshihiro Naruse, et al.	S39
40 Effects of particle size of non-coking coal and inert carbonaceous additives on coke structure and strength after reaction. Chikara Nakamura, et al.	S40
41 Utilization technology of high volatile slightly caking coal for conventional coke. Katsutoshi Igawa, et al.	S41

42	Prediction of deposited carbon in the coke oven. Kunihiko Nishioka, et al.	S42
43	Coke sampling and coke quality in oven chamber. (Distributions of coke quality in coke oven chamber--I). Ikuo Komaki, et al.	S43
44	Estimate of the yield of coke breeze. (Distribution of coke quality in coke oven chamber--II). Katsuaki Kobayashi, et al.	S44
45	Carbon deposit from coals and petroleum-pitchs. Hisatsugu Izuhara, et al.	S45
46	Coke battery temperature control system. Kunitoshi Hashimoto, et al.	S46
47	Relation between properties of cokes and temperature conditions at carbonization in the coke oven. Kazuma Amamoto, et al.	S47
48	Control measure of post reaction strength of coke with the same cold strength of coke. Hidehiro Katahira, et al.	S48
49	Waste heat recovery method by regenerator in ascension pipe. Norio Otabe, et al.	S49
50	Construction and operation of coke dry quench equipment with high pressure steam pipings. Tomio Inoue, et al.	S50
51	COG sensible heat recovery system. Satoshi Fujiyoshi, et al.	S51

APRIL 2, 1983

52	Experiment on burden distribution by 1/10 and 1/1 scale models. (Study on burden distribution in bell-less top--I). Norio Saito, et al.	S52
53	Development of a simulation model of burden distribution. (Study on burden distribution in bell-less top--II). Hiroaki Nishio, et al.	S53
54	Discharging phenomena of raw materials from bell-less top bunker. (Test results by a full-scale experimental blast furnace apparatus with bell-less top--II). Tadatsugu Joko, et al.	S54
55	Circumferential size distribution of burden material at a bell type blast furnace. Kazuhiko Yoshida, et al.	S55
56	Effects of charging methods on particle segregation. (Studies of the mechanisms of burden distribution in the blast furnace--III). Ken-ichi Asai, et al.	S56
57	Collapse of coke layer by dumping ore into blast furnace. (Studies on forming mechanism of burden distribution--I). Isao Ogata, et al.	S57
58	The new method on burden distribution control. Toshiro Sawada, et al.	S58
59	The operation of Nagoya No. 1 Blast Furnace of Nippon Steel Corp. using two kinds of sintered ore classified by size. (The research for the control of burden distribution of the bell-less top blast furnace--I). Takashi Miwa, et al.	S59
60	Gas permeability of burden materials by blast furnace shaft model. Masakata Shimizu, et al.	S60
61	Formation of mixed burden layer near blast furnace wall with a large cold model. (Research on burden and gas flow inside the blast furnace shaft--I). Morimasa Ichida, et al.	S61
62	Forming mechanism of mixed burden layer near blast furnace wall and its effect on gas flow. (Research on burden and gas flow inside the blast furnace shaft--II). Morimasa Ichida, et al.	S62
63	Phenomena in lumpy-zone at lower blast temperature and lower blast humidity operation. (Test operation at Hirohata No. 3 BF, Nippon Steel Corp.--I). Kiyoshi Shibata, et al.	S63
64	Automatic sample preparing equipment for testing of ironmaking materials. Kenji Suzawa, et al.	S64
65	Discharging behavior of raw materials from ore bin. Yasuhiko Sakaguchi, et al.	S65
66	An experiment on operating condition of drum mixer. (Development for preparation of raw materials centering around the improvement of quasy-particles--I). Yoshiaki Shimakawa, et al.	S66
67	Development of quality monitoring system of iron ore bed. (The project for quality stabilization of raw materials--III). Shin-ichiro Yamana, et al.	S67
68	Development of operation guide system for sintering operation. Akira Sasaki, et al.	S68
69	Adoption of DDC system and information system to sinter plant. (Development of Mizushima sinter system of Kawasaki Steel Corp.--I). Osamu Iida, et al.	S69
70	Application of remote control by color display and key board to sinter plant. (Development of Misushima sinter system of Kawasaki Steel Corp.--II). Shuji Taniyoshi, et al.	S70
71	Recovering waste heat of sinter cooler by heat transfer numerical calculation. Tadayuki Minoura, et al.	S71
72	Main exhaust gas circulation system at Kokura No. 3 Sintering Plant, Sumitomo Metal Industries, Ltd. Kazuaki Sato, et al.	S72
73	Red zone measurement of sinter cake. (Development of sintering heat pattern--I). Yoshifumi Matsunaga, et al.	S73
74	Main waste heat recovery system of Oita No. 2 Sintering Plant, Nippon Steel Corp. Hideo Hurutaku, et al.	S74
75	Operation of the waste heat recovery system of Tobata No. 3 Sinter Plant, Nippon Steel Corp. Wataru Fujiki, et al.	S75

APRIL 3, 1983

77 Coke sampler for sampling coke from blast furnace tuyere. Tetsu Nishi, et al.	S77
78 The recovery system for relieving BFG and its operation. Masaki Baba, et al.	S78
79 Test result of cooling of No. 1 hot stove at Kimitsu No. 3 Blast Furnace of Nippon Steel Corp. Katsumi Nakamoto, et al.	S79
80 Development of control methods of hot stove with dynamic model and its application. Koichi Otsuka, et al.	S80
80 Cast house dedusting system of the blast furnace. Shoji Nitta, et al.	S81
82 Stationary shaft gas sampler for the blast furnace. Hiroyuki Yoshioka, et al.	S82
83 Investigation of the root of the cohesive zone in an operating blast furnace by using optical fiber. Yutaka Miyabe, et al.	S83
84 Development of vertical probe equipped with fiber scope. (Investigation of materials behaviour in blast furnace by vertical probe--III). Toshiyuki Irita, et al.	S84
85 Analysis of photograph obtained with high speed camera in the raceway. (Investigation of Raceway--IV). Kazuyoshi Yamaguchi, et al.	S85
86 Alkali circulating material in the lower part of the blast furnace. Masayoshi Amatsu, et al.	S86
87 Si content in iron in dissected Nagoya No. 1 Blast Furnace of Nippon Steel Corp. Hiroji Sato, et al.	S87
88 Relation between the sinter properties in the blast furnace and the blast furnace operation. (Study on the property of burden materials in the shaft of blast furnace--III). Kohji Kawaoka, et al.	S88
89 Tuyere coke properties at steelmaking iron and foundry iron production. Shin-ya Okamoto, et al.	S89
90 Change of coke properties in the blast furnace. Kazuyoshi Yamaguchi, et al.	S90
91 The degradation of coke in the blast furnace. (Report on the dissection of No. 1 Blast Furnace of Nagoya Works, Nippon Steel Corp.--V). Hiroshi Haraguchi, et al.	S91
92 Tensile strength of cokes at high temperature. Tsuneo Isoo, et al.	S92
93 Permeability of cohesive layer in the blast furnace. Hidetoshi Yamaguchi, et al.	S93
94 Examination on fluid state region of iron in a blast furnace hearth by the tracer method. Toshio Onoye, et al.	S94
95 Fundamental studies on fracture toughness of refractories. Manabu Miyamoto, et al.	S95
96 Application of the automatic shaft gunning equipment for blast furnace. Naoki Tsutsui, et al.	S96
97 Behavior of silica brick under heat cycle. Tadahisa Arahori, et al.	S97
98 Effect of drying to prevent the lining damage. Yoshiyasu Morita, et al.	S98
99 Effect of blast temperature and moisture content on hearth condition. (Test operation at Hirohata No. 3 BF, Nippon Steel Corp.--II). Yasushi Takamoto, et al.	S99
100 Blown out operation with lowering the stock level to the tuyere at Kimitsu No. 3 Blast Furnace, Nippon Steel Corp. Aiichiro Sakamoto, et al.	S100
101 Kawasaki Steel's Mizushima No. 2 blast furnace operation at low productivity. Kanji Takeda, et al.	S101
102 The operation of Kakogawa No. 3 Blast Furnace of Kobe Steel, Ltd. with low Si content. Junpei Kiguchi, et al.	S102
103 Rheological properties of petroleum coke-oil slurry. (Development of injection technique of petroleum coke-oil slurry into blast furnace--VI). Shigeki Sasahara, et al.	S103
104 Characteristics of pulverized coal transport and distribution. Kouji Takatani, et al.	S104
105 Combustion characteristics of pulverized coal in pressurized state. Hiroyumi Wakimoto, et al.	S105
106 Pulverized coal injection test at Wakayama No. 4 BF of Sumitomo Metal Industries, Ltd. Masahiro Motoshige, et al.	S106
107 Combustion properties of heavy fuel oil-water emulsion. Masaaki Hibi, et al.	S107
108 Flow properties of coal and tar mixture. Yasuo Kamei, et al.	S108
109 Development of a new pulverized coal burner and distributor for ignition furnaces of sinter plants. (Development of pulverized coal combustion method for ignition furnaces of sinter plants--I). Yutaka Suzuki, et al.	S109
110 Operation results of pulverized coal in ignition furnace of sinter plants. (Development of pulverized coal combustion method for ignition furnaces of sinter plants--II). Hisashi Hashikawa, et al.	S110
111 The segregation charging method of raw materials in sintering. Tadao Maehana, et al.	S111

112 Segregation of raw materials in feeding on the sinter pallets. Shun-ichi Mizukami, et al.	S112
113 Basic investigation of suitable air volume for sintering. Kazumasa Kato, et al.	S113
114 Bonding structures of cold pellet during reduction in elevating temperature. Hideyuki Yoshikoshi, et al.	S114
115 Effect of FeO on the quality of sinter products of various iron ores. (Study on combination of iron ore sinter feeds--IV). Tasuku Takahashi, et al.	S115
116 Effect of FeO on the microstructure of sinter products of various iron ores. (Study on combination of iron ore sinter feeds--V). Hidetaka Hayashi, et al.	S116
117 Measurement of permeability in sintering bed and its evaluation. (Analysis of sintering operation--III). Seiki Nagano, et al.	S117
118 Strength deterioration of synthesized oxides of iron ore-5~10%CaO systems during the reduction at 550 °C in 30%CO-N ₂ gas. Fumio Matsuno, et al.	S118
119 Strength deterioration of synthesized oxides of Fe ₂ O ₃ -CaO-SiO ₂ system during the reduction at 550 °C in 30%CO-N ₂ gas and effect of Al ₂ O ₃ on it. Fumio Matsuno, et al.	S119
120 Strength deterioration of synthesized oxides with big hematite crystals during the reduction at 550 °C in 30%CO-N ₂ gas. Fumio Matsuno, et al.	S120
121 Investigation of relations between structure and quality of sinters from sinter plant. (Quantitative measurement of sinter structure-IV). Katsuhiro Takemoto, et al.	S121
122 Melt formation during sintering. Mineo Sawada, et al.	S122
123 Mechanism of the acicular calcium ferrite formation. Junsuke Haruna, et al.	S123
124 Formation of calcium ferrite during heating. (Production of "acicular calcium ferrite bonded" sinter-I). Kaoru Ito, et al.	S124
125 Mineral composition of fired tablet sample of iron ore mixtures. Shirou Tarumoto, et al.	S125
126 Effect of SiO ₂ particle size on the sintering reaction rate and sinter microstructures. (Study on the sinter qualities--II). Hidetoshi Noda, et al.	S126
127 Relation between mineral structure of agglomerate and its RI. (Production of mineral phase controlled sinter--II). Noboru Sakamoto, et al.	S127
128 Relation between individual mineral structure of agglomerate and its RI. (Production of mineral phase controlled sinter-III). Noboru Sakamoto, et al.	S128
129 Relation between mineral structure of agglomerate and its RDI. (Production of mineral phase controlled sinter-IV). Hiroshi Fukuyo, et al.	S129

-- STEELMAKING --

APRIL 1, 1983

130 Reaction characteristics of desiliconization treatment in iron runner. (Development of continuous desiliconization treatment of hot metal in iron runner--II). Ryuichi Hori, et al.	S130
131 The results of BF runner desiliconization treatment with manganese ore. Hiromitsu Ueki, et al.	S131
132 Application of granulated BOF slag to desiliconization at BF runner. (Development of hot metal continuous treatment--III). Katsuhiro Iwasaki, et al.	S132
133 Development of refractories for desiliconization runner. Kouji Shimomura, et al.	S133
134 Pretreatment of hot metal desiliconization in a torpedo-car. Hideo Matsui, et al.	S134
135 Basic research about the conditions to suppress slag foaming in desiliconization of hot metal. Shinya Kitamura, et al.	S135
136 Preferred removal of silicon to niobium from molten pig iron. (Refining of require containing Nb--I). Akira Sato, et al.	S136
137 Resulfurization during desiliconization of hot metal. Norio Misaki, et al.	S137
138 Properties of refractories for hot metal desiliconization. (Development of hot metal continuous treatment--IV). Masaaki Nishi, et al.	S138
139 The effect of feeding speed on the refining reactions in soda injection treatment. Osamu Yamase, et al.	S139
140 Comparison between bottom injection and top blowing during hot metal treating process by using of Na ₂ CO ₃ . Yoshiro Nakajima, et al.	S140
141 Fundamental study on soda ash recovery from soda slag. Shuzo Ito, et al.	S141
142 Production of low phosphorous steel by hot metal treatment. (Development of hot metal pretreatment process--III). Kazuyuki Yamada, et al.	S142
143 Stainless steel making in BOF with hot metal deposphorization.	S142

(Development of a new stainless steel making process--I).	
Kimiharu Kanakogi, et al.	S143
144 Comparison of metallurgical characteristics between lime-based and soda-based slags for hot metal treatment. Hideo Nakamura, et al.	S144
145 Softing points of slags after hot metal pretreatments and their effects on dephosphorization and desulfurization. Shuji Takeuchi, et al.	S145
146 Effects of gaseous oxygen, slag basicity on dephosphorization of hot metal. Kenji Saito, et al.	S146
147 Hot metal treatment using LD slag. Sumio Shiomi, et al.	S147
148 Hot metal desulfurizing fluxes with improved reaction efficiency. (Development of hot metal desulfurization with CaCO_3 base fluxes--I).	
Hitoshi Morishita, et al.	S148
149 Effects of CaF_2 and CaCl_2 on dephosphorization and desulfurization of molten 4%Fe with CaO-based flux. Yoshimori Fukuda, et al.	S149
150 The blasting method. (Newly developed hot metal dephosphorization technique). Yoshihiro Matsumura, et al.	S150
151 Comparison of processes for dephosphorization of hot metal. Norio Misaki, et al.	S151
152 Influence of operational techniques on surface quality of C.C. bloom. Susumu Ishiguro, et al.	S152
153 The prevention of surface fine cracks on continuously cast large section blooms. Susumu Tsujita, et al.	S153
154 Cause and countermeasure of large sub-surface inclusions in continuous casting bloom. Kazuo Kanamaru, et al.	S154
155 Operation of round billet caster and improvement of cast billet roundness. (Round billet casting process--I). Chitoshi Matsumura, et al.	S155
156 Fine intergranular surface cracks in bloom casting. M. Wolf.	S156
157 Influence of the casting conditions on the surface quality of high carbon steel slabs. (Continuous casting of high carbon tool steels--II).	
Mitsuru Nikaido, et al.	S157
158 Facial longitudinal cracks of middle carbon C.C. slabs. Toshiro Fujiyama, et al.	S158
159 Improvement on slab surface of continuous casting of stainless steel. Hirokazu Tozawa, et al.	S159
160 Development of a concave meter in beneath the mold. (Researches on the prediction of break out--III). Masao Osame, et al.	S160
161 The development of the powder film thickness measurement. (The development of the measurement method of the powder flow condition between a mould and a C.C. slab--I). Yukio Nakamori, et al.	S161
162 Application of friction between mold and strand to casting operation. (Friction between mold and strand in continuous cast slab--II).	
Kazuhisa Hamagami, et al.	S162
163 Design for optimum viscosity of molten powder considering Al_2O_3 absorption. (Study on the mold powder technology in continuous casting--V).	
Taketo Nakano, et al.	S163
164 Analyzing the lubrication between mold and shell by a mold simulator. (Study on the mold powder technology in continuous casting--VI).	
Teiichi Andou, et al.	S164
165 Development and application of air/water mist spray system for continuous casting. Yuji Tanaka, et al.	S165
166 Development of mist cooling method. (Improvement of secondary cooling system in bloom C.C.--I). Shohei Murakami, et al.	S166
167 Development of dynamic control system. (Improvement of secondary cooling system in bloom C.C.--II). Takayuki Shimizu, et al.	S167
168 Heat transfer characteristics and surface temperature behaviour of C.C. slabs in air-water mist cooling. (The development of mist-cooling technique for continuous casting--I). Keiji Nakajima, et al.	S168
169 Measurement of critical strain for internal cracking in continuously cast slabs. Tooru Matsumiya, et al.	S169
170 Finite element analysis for slab straightening with liquid core. (Development of the "low-strain" slab caster--III). A. Vaterlaus.	S170
171 Analytical study on changes of thickness and pressure of a grain-boundary liquid film in a solidifying shell under a steady extension. Susumu Oki.	S171
172 Ductility behaviour of high carbon (1.2 % C) steels at high temperature. (Continuous casting of high carbon tool steels--I). Einao Anzai, et al.	S172
173 Hot ductility and deformation resistance in high speed tensile test of continuous casting slabs. Chihiro Nagasaki, et al.	S173
174 A thermodynamic study of $\text{CaO}-\text{CaF}_2-\text{FeO}$ fluxes for use in the dephosphorization of hot metal. Noriaki Yamada, et al.	S174
175 Measurement of Na_2O activity and phosphorus distribution for the soda slag system. Fumiaki Matsumoto, et al.	S175
176 Effect of CaCO_3 on desulfurization reaction. (Development of hot metal desulfurization with CaCO_3 base fluxes--II). Yoshiaki Hara, et al.	S176
177 Rate of transport of phosphorus silicon and oxygen from liquid iron to slag. Sadao Doi, et al.	S177

178	Decarburization by oxide-powder injection from a top lance under reduced pressure. Kaoru Shinme, et al.	S178
179	Production of ultra-low carbon steel by RH degasser. Tatsuo Hoshida, et al.	S179
180	Development of ultra low sulphur stainless steel produced by flux refining in RH process. (Technique of ultra low sulphur stainless steel making by LD-RH-OB process--I). Noriyuki Masumitsu, et al.	S180
181	The behavior of nitrogen during vacuum induction melting. Hideo Katagiri, et al.	S181
182	A latest steelmaking process in Chita Plant, Daido Steel Co., Ltd. Hideaki Inaba, et al.	S182
183	Operation results of steel refining by powder injection equipment. Kimiharu Kanakogi, et al.	S183
184	Operation of vacuum-slag-cleaner (VSC). Yoshimi Komatsu, et al.	S184
185	Manufacturing of high purity steel by ladle refining. (Development of 9 % Ni steel plate with high toughness). Masayoshi Okamura, et al.	S185
186	Dephosphorization of crude stainless steel melt by sodium silicate flux. Kyoji Kunisada, et al.	S186
187	Development of manufacturing process of extremely low phosphorus steel. Yamaguchi Ryuji, et al.	S187
188	Production of clean steel in Yawata No.1 Steel Plant, Nippon Steel Corp. Kimiharu Kanakogi, et al.	S188
189	Development of molten aluminum injection process into steel melt in the ladle. Nagayasu Bessho, et al.	S189
190	The influence of stirring method on mixing of molten steel. (Basic examination of mixing and refining characteristics of molten steel in ladle--I). Kanehiro Ogawa, et al.	S190
191	The influence of stirring method on slag-metal reaction. (Basic examination of mixing and refining characteristics of molten steel in ladle--II). Kanehiro Ogawa, et al.	S191
192	Effect of mold paints on the ingot surface conditions. Tadayoshi Wada, et al.	S192
193	Influence of mold shape on surface defects of killed steel ingot. Takaki Hata, et al.	S193
194	Improvement in quality of pressure cast slabs. Takahisa Hasegawa, et al.	S194
195	Improvements on internal quality of bloom. Kiyoshi Shiwaku, et al.	S195
196	Boundary element method for solidification problems. Chun Pyo Hong, et al.	S196
197	Mathematical model and model study on growth rate of sedimentary zone of ingot. Haruji Nishiwaki, et al.	S197
198	Segregation in one-directional solidified ingot. Kenzou Kuroda, et al.	S198
199	Effect of Nb and Ta content on the macrosegregation of 12 % Cr steels. Hitohisa Yamada, et al.	S199
200	Prediction of internal defects in 12 Cr steel ingot. (Manufacture of 12 Cr steel turbine rotor shaft--I). Kimihiko Akahori, et al.	S200
201	Effect of Cr equivalent on the amount of δ -ferrite and the mechanical properties of 12 Cr steel. (Manufacture of 12 Cr steel turbine rotor shaft--II). Shigeo Maeno, et al.	S201

APRIL 2, 1983

202	Thermal conductivities of firebricks for ironmaking and steelmaking. Yasushi Hasegawa, et al.	S202
203	On the heat and mass transport during melting and dissolution. P. Rademacher, et al.	S203
204	Computer system for steelmaking process control by optical high speed dataway. Tadaaki Iwamura, et al.	S204
205	Indirect measurement of behaviors of process variables in converter process based on the waste gas information. Takeshi Takawa, et al.	S205
206	Control method in converter exhaust gas recovery. Kazuya Iemura, et al.	S206
207	Influence of design, material of filter and deoxidation of steel on the inclusion removal. (Development of inclusion filter--I). Hiroyuki Ichihashi, et al.	S207
208	Development of tundish heater. (Development of temperature regulation of molton steel in tundish--I). Akihiko Ohara, et al.	S208
209	Producing of stainless steel slabs under controlled temperature of molton steel in tundish. (Development of temperature regulation of molton steel in tundish--II). Yutaka Yoshii, et al.	S209
210	Reduction of inclusions in tundish by gate, Ar-gas bubbling and synthetic slag. Hiroki Sakamoto, et al.	S210
211	Influence of tundish capacity on cleanliness of continuous cast slab. Yūsuke Iwanaga, et al.	S211
212	An analysis on the floatation of inclusions in CC tundish. Masayuki Nakada, et al.	S212
213	Effect of Ar-bubbling in tundish on removal of non-metallic inclusions in slab. Hiromitsu Yamanaka, et al.	S213

214	Production of low susceptibility of steel to HIC: The decreasing of non-metallic inclusions--I.	Jun-ichi Fukumi, et al.	S214
215	Origin of sliver defects. (Decrease of sliver defects in cold rolled sheet for deep drawing--I).	Soichi Koishi, et al.	S215
216	Effect of operational conditions of steel making on sliver defects in rolled sheet for deep drawing. (Decrease of sliver defects in cold rolled sheet for deep drawing--II).	Shōichi Hiwasa, et al.	S216
217	Morphological research method of non-metallic inclusions in continuous cast slab.	Masao Iritani, et al.	S217
218	Improvements of ladle refractories life in ASEA-SKF process.	Masahiko Ogami, et al.	S218
219	Development of zirconia bricks in steel ladles.	Akira Matsumura, et al.	S219
220	Results of basic ladle lining by casting process.	Hitoshi Nakamura, et al.	S220
221	Alumina castable refractories for steel teeming ladle.	Motonobu Kobayashi, et al.	S221
222	Effect of properties of magnesia and graphite on properties of MgO-C brick.	Masato Kumagai, et al.	S222
223	Corrosion mechanism of magnesia grain by steel making slag.	Hiroaki Ishii, et al.	S223
224	Development of new coating method. (Development of propane flame-gunning method for repairing BOF linings--I).	Toshio Suwa, et al.	S224
225	Field trials on pilot scale. (Development of propane flame-gunning method for repairing BOF linings--II).	Fukuichi Kitani, et al.	S225
226	Physical properties of flame-gun-formed layers. (Development of propane flame-gunning method for repairing BOF linings--III).	Fukuichi Kitani, et al.	S226
227	Relation between temperature and wear rate of several basic bricks for LD vessels.	Makoto Yokoi, et al.	S227
228	Capacity of oil-fuel type flame gunning burner. (Development of fuel oil type flame gunning method for LD converter--I).	Kazuo Hamai, et al.	S228
229	Performance results of flame gunning repair. (Development of fuel oil type flame gunning method for LD converter--II).	Hiroyuki Ishimatsu, et al.	S229
230	Explanations on construction and operation of No.2 continuous Casting plant at Kure Works, Nissin Steel Co., Ltd.	Hiroaki Shinagawa, et al.	S230
231	Construction and operations of the slab continuous casters at Kimitsu No.2 BOF Plant, Nippon Steel Corp. (Development of high production C.C.M--I).	Daijiro Mizukoshi, et al.	S231
232	The features of the slab continuous casters at Kimitsu No.2 BOF Plant, Nippon Steel Corp., and the quality of their products. (Development of high production C.C.M--II).	Masamitsu Wako, et al.	S232
233	Development of the vertical multi-point bending and multi-point unbending caster. (Development of high production C.C.M--III).	Yasuyuki Eda, et al.	S233
234	Measurements of reaction forces on rollers in the straightening zones of a continuous casting machine of a vertical bending type.	Kunihiro Onishi, et al.	S234
235	Improvement of narrow face supporting method for continuous caster.	Tokio Yamamoto, et al.	S235
236	Development of cooling pattern in continuous casting mould.	Kazuma Inaoka, et al.	S236
237	Extension of C.C. mold life by composite coating.	Susumu Ishiguro, et al.	S237

APRIL 3, 1983

238	Structure of gas jet injected through nozzle in liquid metal.	Masamichi Sano, et al.	S238
239	Pressure measurement inside a gas-water jet at the top of a nozzle and mechanism of movement of water into the jet.	Ryukichi Oh, et al.	S239
240	Effect of stirring on the rate of reaction between liquid slag and metal.	Masahiro Hirasawa, et al.	S240
241	Fluid flow and mixing time in the ladle with bottom gas blowing.	Ikuro Sawada, et al.	S241
242	The effect of operating factors on the swelling of bath surface of bottom blowing, and combined blowing model converter. (Development of sencer lance technique of bottom blowing, and top and bottom blowing converter--I).	Yoshiei Kato, et al.	S242
243	Development of sencer lance technique of bottom blowing and combined blowing--II).	Akiteru Tamida, et al.	S243
244	The refining of ultra low carbon steel by combined blowing converter.	Motoyasu Yaji, et al.	S244
245	Dissolved oxygen content in top and bottom blown converter.		

Kazuo Okohira, et al.	S245
246 Soft blowing at the lower slag ratio. Masayasu Kimura, et al.	S246
247 Construction and operation of the LBE process at the No.1 BOF Shop of Kimitsu Works, Nippon Steel Corp. (Study on the top and bottom blowing process with the capacity of varying gas flow rates--I). Toshiya Harada, et al.	S247
248 Estimation of chemical compositions at blow end in top and bottom blowing converter (K-BOP). (Development of top and bottom blowing converter--IX). Haruji Okuda, et al.	S248
249 Improvement of refractories for the top and bottom blowing converter. Hiroyuki Aoki, et al.	S249
250 Development of low phosphorus steel production by low temperature tapping. (Production by combination of NK-CB and NK-AP). Hiroaki Ishikawa, et al.	S250
251 Development of production process for bottom-blown CO ₂ gas. (Application of exhaust gas from iron works--I). Takahiro Toyoda, et al.	S251
252 Bottom plug exchange of 250 t combined blowing vessel at hot state. Takeyuki Hirata, et al.	S252
253 Protection of oxygen blowing nozzle by powder injection. Mamoru Inoue, et al.	S253
254 Measuring method of the nozzle erosion for the top and bottom blowing converter. Kousuke Kurata, et al.	S254
255 High speed decarburization of stainless steel melt by top and bottom blowing of mixed gas. Yoshiie Kato, et al.	S255
256 Metallurgical characteristics of stainless steel making by top and bottom blown converter. (Development of stainless steel making by top and bottom blown converter--I). Yoshiaki Kamidate, et al.	S256
257 Production of low phosphorus stainless steel. Kazuo Kitamura, et al.	S257
258 Interrelations among equilibrium distribution coefficients of solute elements in steel. Hideaki Mizukami, et al.	S258
259 Equilibrium distribution coefficient of Fe-Cr-Ni system. Akira Yamada, et al.	S259
260 Effect of solute interactions on the equilibrium distribution of solute elements between solid and liquid phases in iron base ternary alloys. Toshihiro Tanaka, et al.	S260
261 New etching method for evaluating segregation and casting structure in CC slab. Takamasa Takahashi, et al.	S261
262 The center segregation of continuous cast bloom. Youichi Maruta, et al.	S262
263 Quantitative analysis for center segregation of continuously cast slabs. Hisakazu Mizota, et al.	S263
264 Attenuation of the segregation in CC slabs by the refinement of net-work structure. Shinya Kitamura, et al.	S264
265 Diffusion of phosphorus segregated in C.C. slab center. Shigenori Tanaka, et al.	S265
266 Production of low susceptibility of steel to HIC: The decreasing of semimacro centerline segregation--II. Jun-ichi Fukumi, et al.	S266
267 Formation of fine equi-axed crystal by electromagnetic stirring of steel. (Application of electromagnetic stirring to continuous casting--VI). Shin-ichi Nishioka, et al.	S267
268 Effect of mold EMS on initial solidification. (Effect of EMS in bloom caster--I). Yasutsugu Ogura, et al.	S268
269 Experimental equations of equiaxed crystal ratio and white band by EMS for bloom CC. Isao Suzuki, et al.	S269
270 Improvement of surface quality of continuous cast billet by in-mold electromagnetic stirring. (The technique of electromagnetic stirring of C.C. billet--I). Kenzo Ayata, et al.	S270
271 Improvement of internal quality of continuous cast billet by combination electromagnetic stirring. (The technique of electromagnetic stirring of C.C. billet--II). Kenzo Ayata, et al.	S271
272 Effect of mold EMS on inner structure. (Effect of EMS in bloom caster--II). Yasutsugu Ogura, et al.	S272
273 Development of compact eddy-current type continuous casting mold level meter. (Development on the level sensor in the mold of continuous casting by eddy current method--IV). Seigo Ando, et al.	S273
274 Mould level controlling system at electro-magnetic-blake in slab caster. Masanori Nira, et al.	S274
275 ZrO ₂ -15mol%MgO solid electrolytes for oxygen activity measurement of molten steel. Hajime Nakamura, et al.	S275
276 Measurements of the parameter, P _O , for the determination of the electronic conduction in stabilized zirconia for use as solid electrolyte of oxygen probes. Masanori Iwase, et al.	S276
277 Application of oxygen probe to deoxidation of Fe-C-O melt by Al. Kenzo Yamada, et al.	S277
278 Influence of refractory on deoxidation of steel. Jun-ichi Tsubokura, et al.	S278

279	Activity measurements of Na ₂ O in Na ₂ O-P ₂ O ₅ -SiO ₂ melt by sodium -Al ₂ G ₃ . Shu Yamaguchi, et al.	S279
280	The behavior of phosphorus under low oxygen potential. Satoshi Tabuchi, et al.	S280
281	Oxygen potential in the steel desulfurization by top gas injection. (Oxygen potential in the steel desulfurization by top gas injection). Tsutomu Usui, et al.	S281
282	Dephosphorization of molten high Cr-high Ni-high Mo alloy. Toyoyuki Sakae, et al.	S282
283	Desulfurization of molten high Cr-high Ni-high Mo alloy. Tadahito Sudo, et al.	S283
284	Development of new boron treated steel. Yoshiaki Aoki, et al.	S284
285	Continuous casting of 24 % Mn steel. Jun-ichi Fukumi, et al.	S285
286	Mechanism of wear in immersion nozzles for continuous casting. Taijiro Matsui, et al.	S286
287	Development of tundish coating material with long life and high insulation. Nobutaka Watanabe, et al.	S287
288	Operational results by sliding nozzle. (Adoption of sliding nozzle on tundish--I). Tsuneo Kondo, et al.	S288
289	Improvement of quality by sliding nozzle. (Adoption of sliding nozzle on tundish--II). Taizo Sera, et al.	S289

-- ANALYSIS --

APRIL 2, 1983

290	Quantitative analysis of boron, carbon and phosphorus in steels by ion microanalyzer. Ken-ichi Suzuki, et al.	S290
291	Analysis of oxygen in steel and scale formed on steel surface by ion microprobe mass analyzer. Toshiko Suzuki, et al.	S291
292	Surface structure of oxidized metal after ion sputtering. Yasuhiro Sekimoto, et al.	S292
293	Detection of solute segregation on 2 1/4Cr-1Mo steel surface by glow discharge spectrometry. Suzuya Oshiba, et al.	S293
294	Charge correction of non-conducting samples in X-ray photoelectron spectroscopy. Yoshiharu Ohashi, et al.	S294
295	Analysis of precipitates in steels by electron energy loss spectrometry. Atsushi Yamamoto, et al.	S295
296	A simple method for the determination of nonmetallic inclusion content in super alloys using electron beam melting. Kenji Furukawa, et al.	S296
297	Trace analysis of Al, Ti and Mn in inclusions of carbon steel by neutron activation. Kimio Sugimoto, et al.	S297
298	Influence of Cottrell effect on the determination of free nitrogen in steel by hydrogen hot extraction method. Yoshiro Takizawa, et al.	S298
299	State analysis of Mo ₂ C in Cr-Mo steels by controlled-potential secondary electrolysis method by use of porous-graphite electrode. Yoshiko Funahashi, et al.	S299
300	Determination of P as phosphides and investigation of its precipitating behavior in steel. Atsushi Chino, et al.	S300
301	Determination of the precipitates in maraging steels with various alloying elements. (Effect of precipitation on strength and toughness of maraging steels--IV). Jyo Endo, et al.	S301

APRIL 3, 1983

302	Analysis of tungsten-bearing steel by inductively coupled plasma emission spectrometry. Fumikichi Mogi, et al.	S302
303	Determination of trace amount of phosphorus and boron in steel using high resolution-scanning type ICP-AES. (Selection of optimum analytical line and its application). Yasuharu Matsumura, et al.	S303
304	Determination of trace amounts of boron in steel by inductively coupled plasma emission spectrometry with distillation as methyl borate. Chikara Takeuchi, et al.	S304
305	A new preparation method without sample weighing for steel analysis by inductively coupled plasma atomic emission spectroscopy. Teruo Yoko-oozi, et al.	S305
306	Determination of sol. Al in steel by alternately charge conversion type spark emission spectrometry. Takanori Akiyoshi, et al.	S306
307	Curtailment of sample preparation time on emission spectrometry. Takashi Sugihara, et al.	S307
308	Determining concentration of element in steel by laser microspectral analysis. Nobukatsu Fujino, et al.	S308
309	Analysis of stainless steel by glow discharge spectrometry. Isamu Tanaka, et al.	S309

-
- 310 Spot analysis with a formed filter paper medium by X-ray fluorescence spectrometry. Niriko Yasui, et al. S310
311 Influences of BaO addition in X-ray fluorescence analysis by glass bead technique. Koji Kanetuki, et al. S311
312 Development and application of new type electron probe large area mapping analyzer. Kazumi Morimoto, et al. S312
313 Determination of nitrogen and hydrogen by electron beam fusion-mass spectrometry--I. (Development of analyzer). Syunsuke Goto, et al. S313
314 Determination of nitrogen and hydrogen by electron beam fusion-mass spectrometry--II. (Quantitative analysis). Syunsuke Goto, et al. S314
315 Development of management system for chemical laboratory. Takeji Tamura, et al. S315