

CERTIFICATE OF ACCREDITATION

TurboPowerTech Co., Ltd.

Accreditation No. : KT815

Corporation Registration No. : 180111-0138768

Address of (Branch site) Laboratory : 107 Dasanro, Saha-Gu, Busan, Republic of Korea

Date of Initial Accreditation : November 05, 2018

Validity of Accreditation : November 05, 2022 ~ November 04, 2026

Scope of Accreditation : Attached Annex

Date of issue : November 03, 2022

This testing laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to Joint ISO-ILAC-IAF Communiqué).



Sanghoon Lee

Head

Korea Laboratory Accreditation Scheme

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01. Mechanical Testing

01.001 Metals and Related Products

Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ASME BPVC SEC II SA370:2021	Metal and related products	TEST METHODS AND DEFINITIONS FOR MECHANICAL TESTING OF STEEL PRODUCTS 13.1 TENSILE TEST - Yield Point, 13.2 TENSILE TEST - Yield Strength, 13.3 TENSILE TEST - Tensile Strength, 13.4 TENSILE TEST - Elongation, 13.5 TENSILE TEST - Reduction Area, 14. BEND TEST, 16. HARDNESS TEST - Brinell Test, 17. HARDNESS TEST - Rockwell Test, 25.4.1 CHARPY IMPACT TESTING - Impact energy, 25.4.2 CHARPY IMPACT TESTING - Percentage of Shear Fracture Area, 25.4.3 CHARPY IMPACT TESTING - Lateral Expansion, - A2.2 Tension Test, - A2.5.1.1 Flattening Test, - A2.5.1.2 Reverse Flattening Test, - A2.5.1.5 Flaring Test, - A2.5.1.6 Bend Test, - A2.5.1.7 Transverse Guided Bend Test of Welds	[Tension Test] Test Load : Max. 950 kN, [Hardness Test] Brinell : (4 903 ~ 29 420) N, Rockwell : Scale B : 20 ~ 100, Scale C : 20 ~ 70, [Charpy Impact Test] Absorbed Energy : Max. 400J, Temperature : Room Temp. ~ -196℃, Lateral Expansion : (0 ~ 10) mm, Percentage of Shear Fracture Area : (0 ~ 100) %, [Bend Test] Load : Max. 950 kN, [Flattening/Flaring Test] Load : Max. 950 kN	BS	N
ASME BPVC SEC II SA530/SA530M:2021	Metal and related products	ASME Boiler & Pressure Vessel Code II Materials Part A Ferrous Material Specifications SA530/SA530M SPECIFICATION FOR GENERAL REQUIREMENTS FOR SPECIALIZED CARBON AND ALLOY STEEL PIPE 19. Flattening Test Requirements	Test Load : Max. 950 kN	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ASME BPVC SEC II SA999/SA999M:2021	Metal and related products	ASME Boiler & Pressure Vessel Code II Materials Part A Ferrous Material Specifications SA999/SA999M SPECIFICATION FOR GENERAL REQUIREMENTS FOR ALLOY AND STAINLESS STEEL PIPE 21. Flattening Test Requirements	Test Load : Max. 950 kN	BS	N
ASME BPVC SEC I :2021	Metal and related products	ASME Boiler & Pressure Vessel Code I RULES FOR CONSTRUCTION OF POWER BOILERS PW-53.7 TENSION TESTS PW-53.8 BEND TESTS	PW-53.7 Tension Test Test Load : Max. 950 kN, Elongation/Reduction of Area : (1 ~ 100) %, Elongation at Fracture : (1 ~ 50) %, PW-53.8 Bend Test Test Load : (5 ~ 950) kN	BS	N
ASME BPVC Section IX:2021	Metal and related products	QUALIFICATION STANDARD FOR WELDING, BRAZING, AND FUSING PROCEDURES; WELDERS; BRAZERS; AND WELDING, BRAZING, AND FUSING OPERATORS PART QW WELDING, ARTICLE 1. WELDING GENERAL REQUIREMENTS, QW-150 TENSION TESTS, QW-170 NOTCHTOUGHNESS TESTS	QW-150 Tensile test - Test load : Max. 950 kN, QW-160 Guided-bend test - Load : Max. 950 kN, QW-170 Charpy Impact Test - Absorbed Energy : Max. 400 J, Temperature : Room Temp. ~ -196°C, Lateral Expansion : (0 ~ 10) mm, Percentage Shear area : (0 ~ 100) %	BS	N
ASTM A1016/A1016M-18a	Metal and related products	Standard Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes 19. Flattening Test 20. Reverse Flattening Test	Test Load : Max. 950 kN	BS	N

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ASTM A370-21	Metal and related products	STANDARD TEST METHODS AND DEFINITIONS FOR MECHANICAL TESTING OF STEEL PRODUCTS 14.1 TENSION TEST - Yield Point, 14.2 TENSION TEST - Yield Strength, 14.3 TENSION TEST - Tensile Strength, 14.4 TENSION TEST - Elongation, 14.5 TENSION TEST - Reduction of Area, 15. BEND TEST, 17. HARDNESS TEST - Brinell Test, 18. HARDNESS TEST - Rockwell Test, 26.4.1 CHARPY IMPACT TESTING - Impact energy, 26.4.2 CHARPY IMPACT TESTING - Percentage of Shear Fracture Area, 26.4.3 CHARPY IMPACT TESTING - Lateral Expansion	[Tension Test] Yield Point : Max. 950 kN, Yield Strength : Max. 950 kN, Tensile Strength : Max. 950 kN, Elongation : (0 ~ 100) %, Reduction of Area : (0 ~ 100) %, [Hardness Test] Brinell : (4 903 ~ 29 420) N, Rockwell : Scale B : 20 ~ 100, Scale C : 20 ~ 70, [Bend Test] Test Load : Max. 950 kN, [Charpy Impact Test] Absorbed Energy : Max. 400 J, Temperature : Room Temp. ~ -196℃, Lateral Expansion : (0 ~ 25) %, Percentage of Shear Fracture Area : (0 ~ 100) %	BS	N
ASTM A530/A530M-18	Metal and related products	Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe 21. Flattening Test Requirements	Test Load : Max. 950 kN	BS	N
ASTM A999/A999M-18	Metal and related products	Standard Specification for General Requirements for Alloy and Stainless Steel Pipe 21. Flattening Test Requirements	Test Load : Max. 950 kN	BS	N
ASTM E10-18	Metal and related products	Standard Test Method for Brinell Hardness of Metallic Materials	(4 903 ~ 29 420) N	BS	N
ASTM E139- 11(2018)	Metal and related products	Standard Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic materials	Max. Temp. : 1 000 ℃, Max. Load : 200 kg	BS	N
ASTM E18-22	Metal and related products	Standard Test Method for Rockwell Hardness of Metallic Materials	Scale B : 20 ~ 100, Scale C : 20 ~ 70	BS	N

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ASTM E190-21	Metal and related products	Standard Test Method for Guided Bend Test for Ductility of Welds	Test Load : Max. 950 kN	BS	N
ASTM E21-20	Metal and related products	Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials	Tensile Strength : Max. 45 kN, Yield Strength : Max. 45 kN, Elongation : (0 ~ 100) %, Reduction of Area : (0 ~ 100) %, Test Temperature : Room Temperature ~ 1 000 °C	BS	N
ASTM E23-18	Metal and related products	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials	Absorbed Energy : Max. 400 J, Temperature : Room Temp, ~ -196°C, Lateral Expansion : (0 ~ 10) mm, Percentage of Shear Fracture Area : (0 ~ 100) %	BS	N
ASTM E290-14	Metal and related products	Standard Test Methods for Bend Testing of Material for Ductility	Test Load : Max. 950 kN	BS	N
ASTM E292-18	Metal and related products	Standard Test Methods for Conducting Time-for-Rupture Notch Tension Tests of Materials	Max. Temp. : 1 000 °C, Max. Load : 200 kg	BS	N
ASTM E384-17	Metal and related products	Standard Test Method for Microindentation Hardness of Materials	(0.980 7 ~ 9.807) N	BS	N
ASTM E8/E8M-21	Metal and related products	Standard Test Methods for Tension Testing of Metallic Materials	Tensile Strength : Max. 950 kN, Yield Strength : Max. 950 kN, Elongation : (0 ~ 100) %, Reduction of Area : (0 ~ 100) %	BS	N
ASTM E92-17	Metal and related products	Standard Test Methods for Vickers Hardness and Knoop Hardness of Metallic Materials	Vickers Hardness Test Load : (0.980 7 ~ 294.21) N	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
AWS B4.0:2016	Metal and related products	AWS B4.0 : 2016 Standard Methods for Mechanical Testing of Welds 4. Tension Tests 6. Bend Tests 7. Fracture and Notch Toughness Tests 7.7.1. (2) Charpy V notch 8. Hardness Tests	4. Tension Tests Test Load : Max. 950 kN, Elongation/Reduction of Area : (1 ~ 100) %, Elongation at Fracture : (1 ~ 50) % kN, 6. Bend Tests Test Load : (5 ~ 950) kN, 7. Fracture Toughness Tests 7.7.1. (2) Charpy V- notch Absorb Energy : Max. 434 J, Temperature : Room. Temp. ~ -196°C, Lateral Expansion : (0.01 ~ 5) mm %, Shear area : Max. 100 %, 8. Hardness Tests Brinell : Test Load (9 800 ~ 29 420) N, Rockwell : Scale B, C, Vickers : HV 10, Microhardness : HV 0.2 ~ HV 0.5	BS	N
AWS D1.1M/D1.1:2020	Metal and related products	Structural Welding Code - Steel - 6.10.3 Mechanical Testing - Bend Test, Tension Test	6.10.3 Mechanical Testing - Bend Test Load : Max. 950 kN, - Tension Test Load : Max. 950 kN, Reduction of Area : (1 ~ 100) %, Elongation : (1 ~ 100) %	BS	N
ISO 148-1:2016	Metal and related products	Metallic materials - Charpy pendulum impact test - Part 1 : Test method	Charpy Absorbed Energy : Max. 400 J, Temperature : Room. Temp ~ -196°C, Lateral Expansion : (0 ~ 10) mm, Percent Shear area : (0 ~ 100) %	BS	N
ISO 204:2018	Metal and related products	Metallic materials -- Uniaxial creep testing in tension -- Method of test	Max. Temp. : 1 000 °C, Max. Load : 200 kg	BS	N
ISO 4136:2012	Metal and related products	Destructive tests on welds in metallic materials - Transverse tensile test	Test Load : Max. 950 kN	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ISO 5173:2009	Metal and related products	Destructive tests on welds in metallic materials -- Bend tests	Test Load : Max. 950 kN	BS	N
ISO 5178:2019	Metal and related products	Destructive tests on welds in metallic materials - Longitudinal tensile test on weld metal in fusion welded joints	Test Load : Max. 950 kN	BS	N
ISO 6506-1:2014	Metal and related products	Metallic materials - Brinell hardness test - Part 1 : Test method	(4 903 ~ 29 420) N	BS	N
ISO 6507-1:2018	Metal and related products	Metallic materials - Vickers hardness test - Part 1 : Test method	(0.980 7 ~ 294.21) N	BS	N
ISO 6508-1:2016	Metal and related products	Metallic materials - Rockwell hardness test - Part 1 : Test method	Scale B : 20 ~ 100, Scale C : 20 ~ 70	BS	N
ISO 6892-1:2019	Metal and related products	Metallic materials - Tensile testing - Part 1 : Method of test at room temperature	Tensile Strength : Max. 950 kN, Upper yield strength : Max. 950 kN, Lower yield strength : Max. 950 kN, Percentage total extension at fracture : (0 ~ 100) %, Percentage reduction of area : (0 ~ 100) %	BS	N
ISO 6892-2:2018	Metal and related products	Metallic materials - Tensile testing - Part 2 : Method of test at elevated temperature	Test Load : Max. 45 kN, Elongation/Reduction of Area : (0 ~ 100) %, Elongation at fracture : (0 ~ 100) %, Test Temperature : Room Temperature ~ 1 000°C	BS	N
ISO 7438:2020	Metal and related products	Metallic materials -- Bend test	Test Load : Max. 950 kN	BS	N
ISO 8491:1998	Metal and related products	Metallic materials -- Tube (in full section) -- Bend test	Test Load : Max. 950 kN	BS	N
ISO 8492:2013	Metal and related products	Metallic materials -- Tube -- Flattening test	Test Load : Max. 950 kN	BS	N
ISO 8493:1998	Metal and related products	Metallic materials -- Tube -- Drift-expanding test	Test Load : Max. 950 kN	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ISO 9015-1:2001	Metal and related products	Destructive tests on welds in metallic materials - Hardness testing - Part 1 : Hardness test on arc welded joints	HV 10	BS	N
ISO 9015-2:2016	Metal and related products	Destructive tests on welds in metallic materials - Hardness testing - Part 2 : microhardness testing of welded joints	HV 0.1, HV 1	BS	N
ISO 9016:2022	Metal and related products	Destructive tests on welds in metallic materials - Impact tests - Test specimen location, notch orientation and examination	Max. Absorbed Energy 400J, Striker 8 mm	BS	N
ISO 9018:2015	Metal and related products	Destructive tests on welds in metallic materials - Tensile test on cruciform and lapped joints	Test Load : Max. 950 kN	BS	N
JIS G 3454:2017 / AMENDMENT1:20 19	Metal and related products	Carbon steel pipes for pressure service 6.2 Flattening Test	Test Load : Max. 950 kN	BS	N
JIS G 3459:2021	Metal and related products	Stainless steel pipes 13.2.4 Flattening Test	Test Load : Max. 950 kN	BS	N
JIS G 3461:2019	Metal and related products	Carbon steel tubes for boiler and heat exchanger 6.2 Flattening Test	Test Load : Max. 950 kN	BS	N
JIS G 3463:2019	Metal and related products	Stainless steel tubes for boiler and heat exchanger 6.2 Flattening resistance 6.4 Reverse flattening resistance	Test Load : Max. 950 kN	BS	N
JIS Z 2241:2011	Metal and related products	Metallic materials - Tensile testing - Method of test at room temperature	Tensile Strength : Max. 950 kN, Upper yield strength : Max. 950 kN, Lower yield strength : Max. 950 kN, Percentage total extension at fracture : (0 ~ 100) %, Reduction of area : (0 ~ 100) %	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
JIS Z 2242:2018	Metal and related products	Method for Charpy pendulum impact test of metallic materials	Absorbed Energy : Max. 400 J, Temperature : Room Temp, ~ -196℃, Lateral Expansion : (0 ~ 10) mm, Percentage of Shear Fracture Area : (0 ~ 100) %	BS	N
JIS Z 2243-1:2018	Metal and related products	Brinell hardness test - Part 1 : Test method	(4 903 ~ 29 420) N	BS	N
Jis Z 2244-1:2020	Metal and related products	Vickers hardness test -- Part 1 : Test method	(0.980 7 ~ 294.21) N	BS	N
JIS Z 2245:2021	Metal and related products	Rockwell hardness test - Test method	Scale B : 20 ~ 100, Scale C : 20 ~ 70	BS	N
JIS Z 2248:2022	Metal and related products	Metallic materials -- Bend test	Test Load : Max. 950 kN	BS	N
JIS Z 3121:2013	Metal and related products	Methods of tensile test for butt welded joints	Test Load : Max. 950 kN	BS	N
JIS Z 3122:2013	Metal and related products	Methods of bend test for butt welded joint	Test Load : Max. 950 kN	BS	N
KS B 0802:2003	Metal and related products	Methods of Tensile Test for Metallic Materials	Tensile Strength : Max. 950 kN, Yield Strength : Max. 950 kN, Elongation : (0 ~ 100) %, Reduction of Area : (0 ~ 100) %	BS	N
KS B 0804:2001	Metal and related products	Metallic Materials - Bend test	Test Load : Max. 950 kN	BS	N
KS B 0805:2000	Metal and related products	Methods of Brinell Hardness Test for Metallic Materials	(4 903 ~ 29 420) N	BS	N
KS B 0806:2000	Metal and related products	Methods of Rockwell Hardness Test for Metallic Materials	Scale B : 20 ~ 100, Scale C : 20 ~ 70	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
KS B 0810:2003	Metal and related products	Methods of Impact Test for Metallic Materials	Absorbed Energy : Max. 400 J, Temperature : Room Temp, ~ -196℃, Lateral Expansion : (0 ~ 10) mm, Percentage of Shear Fracture Area : (0 ~ 100) %	BS	N
KS B 0811:2003	Metal and related products	Methods of Vickers Hardness Test for Metallic Materials	(0.980 7 ~ 294.21) N	BS	N
KS B 0814:2001	Metal and related products	Methods of tensile creep test for metallic materials	Max. Temp. : 1 000 ℃, Max. Load : 200 kg	BS	N
KS B ISO 5173:2009	Metal and related products	Destructive tests on welds in metallic materials -- Bend Test	Test Load : Max. 950 kN	BS	N
KS B ISO 8492:1998	Metal and related products	Metallic Materials - Tube - Flattening Test	Test Load : Max. 950 kN	BS	N
KS B ISO 8493:1998	Metal and related products	Metallic materials -- Tube -- Drift-expanding test	Test Load : Max. 950 kN	BS	N
KS D 0026:2002	Metal and related products	Methods of Tensile Test at elevated temperature for Ferrous Metal and Heat Resisting Alloy	Test Load : Max. 45 kN, Elongation/Reduction of Area : (0 ~ 100) %, Elongation at fracture : (0 ~ 100) %, Test Temperature : Room Temperature ~ 1 000℃	BS	N

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02. Chemical Testing

02.001 Steel

Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ASTM A751-21	Steel	Standard Test Methods and Practices for Chemical Analysis of Steel Products	C(0.004 ~ 4.174) %, S(0.000 5 ~ 0.1) %, N ₂ (0.002 0 ~ 0.3) %, Mn(0.005 ~ 15.0) %, P(0.001 ~ 1.5) %, Si(0.005 ~ 3.67) %, Cr(0.01 ~ 26.0) %, Ni(0.01 ~ 20.05) %, Al(0.001 8 ~ 5.5) %, Mo(0.005 ~ 8.0) %, Cu(0.005 ~ 4.0) %, Cb(0.005 ~ 1.438) %, V(0.005 ~ 1.82) %, Ti(0.005 ~ 0.313) %, Co(0.005 ~ 4.0) %, Sn(0.001 ~ 0.20) %, W(0.005 ~ 3.0) %, Pb(0.002 ~ 0.05) %, B(0.000 5 ~ 0.05) %, Ca(0.000 2 ~ 0.000 7) %, Mg(0.001 ~ 0.01) %, Ce(0.001 ~ 0.024 5) %, Zr(0.012 ~ 0.074) %, Ta(0.007 ~ 0.116) %	BS	N
ASTM E1086-14	Steel	Standard Test Method for Analysis of Austenitic Stainless Steel by Spark Atomic Emission Spectrometry	Cr(17.0 ~ 23.0) %, Ni(7.5 ~ 13.0) %, Mo(0.01 ~ 3.0) %, Mn(0.01 ~ 2.0) %, Si(0.01 ~ 0.90) %, Cu(0.01 ~ 0.30) %, C(0.005 ~ 0.25) %, P(0.003 ~ 0.15) %, S(0.003 ~ 0.065) %	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
ASTM E415-21	Steel	Standard Test Method for Analysis of Carbon and Low-Alloy Steel by Spark Atomic Emission Spectrometry	Al(0.006 ~ 0.093) %, Sb(0.006 ~ 0.027) %, As(0.003 ~ 0.064) %, B(0.000 4 ~ 0.007) %, C(0.02 ~ 1.1) %, Cr(0.007 ~ 8.14) %, Co(0.006 ~ 0.20) %, Cu(0.006 ~ 0.5) %, Mn(0.03 ~ 2.0) %, Mo(0.007 ~ 1.3) %, Ni(0.006 ~ 5.0) %, Nb(0.003 ~ 0.12) %, N(0.01 ~ 0.055) %, P(0.006 ~ 0.085) %, Si(0.02 ~ 1.54) %, S(0.001 ~ 0.055) %, Sn(0.005 ~ 0.061) %, Ti(0.001 ~ 0.2) %, V(0.003 ~ 0.3) %, Zr(0.012 ~ 0.05) %	BS	N
JIS G 1253:2002 / AMENDMENT1:20 13	Steel	Iron and steel - Method for spark discharge atomic emission spectrometric analysis	C(0.001 ~ 4.174) %, Si(0.003 9 ~ 3.67) %, Mn(0.003 ~ 28.8) %, P(0.000 8 ~ 1.0) %, S(0.000 2 ~ 0.414) %, Ni(0.002 ~ 20.05) %, Cr(0.002 ~ 30.5) %, Mo(0.001 ~ 9.41) %, Cu(0.001 ~ 4.03) %, V(0.001 ~ 1.82) %, W(0.01 ~ 17.83) %, Co(0.001 2 ~ 7.95) %, Ti(0.000 5 ~ 0.313) %, Al(0.001 8 ~ 5.0) %, As(0.001 ~ 0.064) %, Sn(0.000 6 ~ 0.3) %, B(0.000 12 ~ 0.5) %, Pb(0.001 ~ 0.328) %, Zr(0.012 ~ 0.074) %, Nb(0.001 ~ 1.438) %, Mg(0.001 ~ 0.083 8) %, Sb(0.008 ~ 0.089) %, N(0.001 ~ 0.15) %, Ce(0.005 ~ 0.024 5) %, Ta(0.02 ~ 0.116) %, Ca(0.000 1 ~ 0.000 7) %	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
KS D 1652:2007	Steel	Iron and steel - Method for spark discharge atomic emission spectrometric analysis	C(0.001 ~ 4.174) %, Si(0.003 9 ~ 3.67) %, Mn(0.003 ~ 28.8) %, P(0.000 8 ~ 1.0) %, S(0.000 2 ~ 0.414) %, Ni(0.002 ~ 20.05) %, Cr(0.002 ~ 30.5) %, Mo(0.001 ~ 9.41) %, Cu(0.001 ~ 4.03) %, V(0.001 ~ 1.82) %, W(0.01 ~ 17.83) %, Co(0.001 2 ~ 7.95) %, Ti(0.000 5 ~ 0.313) %, Al(0.001 8 ~ 5) %, As(0.001 ~ 0.064) %, Sn(0.000 6 ~ 0.3) %, B(0.000 12 ~ 0.5) %, Pb(0.001 ~ 0.328) %, Zr(0.012 ~ 0.074) %, Nb(0.001 ~ 1.438) %, Mg(0.001 ~ 0.083 8) %, Sb(0.008 ~ 0.089) %	BS	N

End.