NAS NW400 (UNS N04400)

NAS High Corrosion Resistant Ni-Cu Alloy

NAS NW400 (NW4000, UNS N04400), with a composition comprising Ni and Cu, is an alloy which provides a combination of the noble metal properties of Cu and the passivation property of Ni and offers excellent corrosion resistance. Taking advantage of these properties, it is used in seawater desalination plant, heat exchangers, overlay materials for marine structures, and similar applications. Nippon Yakin supplies this product in plate, sheet and strip form.

Grade/Standard

NAS	JIS H4551	ASTM B127	EN
NAS NW400	NW4400	UNS N04400	—

Chemical Composition

[wt %]

	C	Si	Mn	S	Ni	Cu	Fe
Specification (NW4400)	≦0.30	≦0.5	≦2.0	≦0.025	≧63.0	28.0~34.0	≦2.5
Specification (UNS N04400)	≦0.3	≦0.5	≦2.0	≦0.024	≧63.0	28.0~34.0	≦2.5

Physical Properties

Density	[g/cm³]		8.80
Specific heat	[J/kg · K]	20°C	424
Electrical resistivity	[μΩ · cm]		54.7
Thermal conductivity	[W/m · K]		23.9
Average coefficient of thermal expansion	[10⁻⁶/°C]	20~100°C	13.6
		20~200°C	14.1
		20~300°C	14.6
		20~400°C	15.0
Young's modulus	[MPa]		17.8 × 10⁴
Melting range	[°C]		1300~1350

NIPPON YAKIN KOGYO CO., LTD.

Mechanical Properties

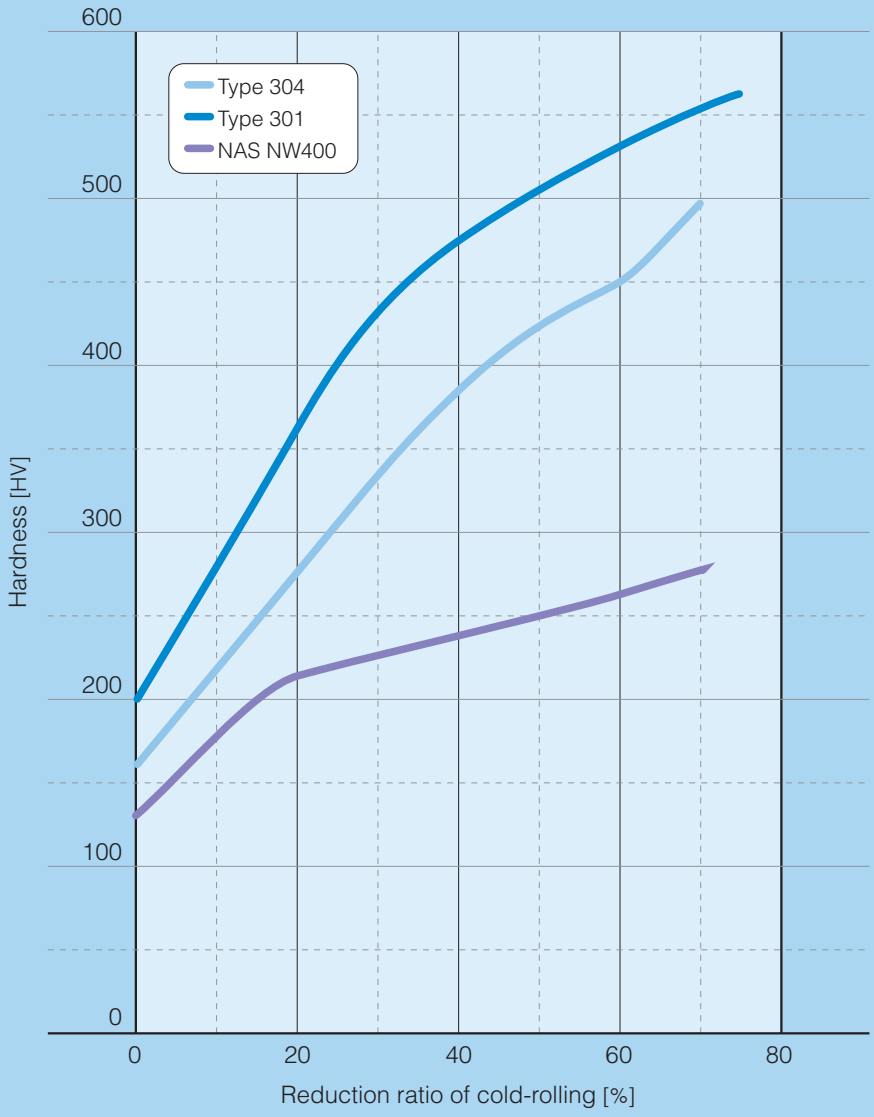
Mechanical Properties at Room Temperature

			0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness [HV]
Specification (NW4400)	Annealing		≧195	≧480	≧35	—
Specification (UNS N04400)	Annealing	Hot-rolled plate	≧195	≧485	≧35	
		Cold-rolled sheet	≧195	485~585	≧35	
Example	Annealing	Hot-rolled plate 12mm^{t}	209	513	52	131

Work Hardening

Because work hardening of NAS NW400 is substantially smaller than that of Type 301 and Type 304, bending forming and similar working can be performed easily.

Results of work hardening test



Corrosion Resistance

Acid Resistance

Alloy	Corrosion rate in sulfuric acid at 80°C (mm/y)					
	5%	10%	20%	40%	60%	80%
SUS 316L	1.67	4.69	71.91	764.9	704.5	33.74
NAS 64	<0.01	0.02	1.07	191.9	1054	60.72
NAS 254N	0.02	0.05	1.02	2.11	2.16	7.76
NAS NW400	0.28	0.27	0.20	0.16	0.14	0.80

Test time: 24h

Alloy	Corrosion rate in boiling sulfuric acid (mm/y)			
	5%	10%	20%	40%
SUS 316L	8.19	24.61	178.9	3129
NAS 64	0.35	1.65	17.68	2829
NAS 254N	1.17	3.30	7.90	24.65
NAS NW400	0.21	0.36	0.53	2.12

Test time: 24h

Alloy	Corrosion rate in hydrochloric acid at 80°C (mm/y)			
	0.1%	1%	2%	3%
SUS 316L	0.02	2.73	6.75	14.88
NAS 64	0.01	0.01	12.94	30.51
NAS 254N	0.01	0.02	0.01	9.14
NAS NW400	0.34	0.40	0.46	0.63

Test time: 24h

Alloy	Corrosion rate in boiling formic acid (mm/y)			
	20%	40%	60%	80%
SUS 316L	0.35	0.62	0.73	0.49
NAS 64	0.01	<0.01	0.25	0.40
NAS 254N	0.04	0.11	0.23	0.30
NAS NW400	0.05	0.08	0.05	0.02

Test time: 24h

(Reference)

Nippon Yakin	JIS	UNS No.	Chemical composition
SUS 316L	SUS 316L	S31603	17Cr-12Ni-2Mo
NAS 64	SUS 329J4L	S32506	25Cr-6.5Ni-3.3Mo-0.17N
NAS 254N	SUS 836L	S32053	23Cr-25Ni-5.5Mo-0.2N
NAS NW400	NW4400	N04400	65Ni-32Cu-1Fe

Workability

Because ordinary temperature strength of NAS NW400 is lower than that of Type 304, the cold working such as bending is easier than Type 304.

Weldability

Possible welding methods include shielded metal arc welding, TIG, MIG, and resistance welding. ENiCu-7 welding consumable should be used for TIG and MIG welding.

Heat Treatment

Solution annealing of NAS NW400 is normally performed at the temperature range from 700 to 900°C followed by being quenched in water or rapidly cooled by other means.

Pickling

It should be noted that descaling of NAS NW400 is somewhat difficult in comparison with Type 304.

Applications

Marine structure overlays, seawater desalination plant, salt manufacturing plant, a petroleum refining equipment, ship parts, heat exchangers, valve and pump materials for chemical and seawater desalination plants, etc.

For more information, please contact:
Nippon Yakin Kogyo Co., Ltd.
Material Solutions Sales Department
San-Ei Bldg., 5-8, 1-chome Kyobashi, Chuo-ku,
Tokyo 104-8365 Japan
TEL: +81-3-3273-4649 FAX: +81-3-3273-4642
E-Mail: inquiry@nyk.jp
URL: http://www.nyk.co.jp/en/

2016.6.10