

# NASNW22 (UNS N06022)

## High Corrosion Resistant Nickel Alloy

NASNW22 is a Ni-Cr-Mo alloy with excellent corrosion resistance. This alloy provides excellent pitting corrosion resistance, crevice corrosion resistance, and stress corrosion cracking resistance in both oxidizing and reducing environments, and is widely used as a material under severe environments such as flue gas desulfurization plants, papermaking processes, waste treatment processes, etc.

Nippon Yakin supplies this product in plate, sheet and strip forms.

### Grade/Standard

Nippon Yakin Grade	JIS G 4902	ASTM B575	DIN 17744/17750
NASNW22	NW6022	UNS N06022	2.4602

### Chemical Composition

	C	Si	Mn	P	S	Ni	Cr	Mo	Fe	Co	W	V	[wt %]
Specification (NW6022)	≤0.015	≤0.08	≤0.50	≤0.020	≤0.020	Bal.	20.00~22.50	12.50~14.50	2.00~6.00	≤2.50	2.50~3.50	≤0.35	
Specification (UNS N06022)	≤0.015	≤0.08	≤0.50	≤0.02	≤0.02	Bal.	20.0~22.5	12.5~14.5	2.0~6.0	≤2.5	2.5~3.5	≤0.35	

### Physical Properties

Density	[g/cm <sup>3</sup> ]	8.70
Specific heat	[J/kg · K]	414
Electrical resistivity	[μΩ · cm]	114.0
Thermal conductivity	[W/m · K]	10.0
Average coefficient of thermal expansion [10 <sup>-6</sup> /°C]	20~100°C	11.5
	20~200°C	12.7
	20~300°C	13.0
	20~400°C	13.5
	20~500°C	13.8
Young's modulus	[MPa]	20.4 × 10 <sup>4</sup>
Magnetism		None
Melting range	[°C]	1325~1372

Mechanical Properties

		0.2% proof stress [MPa]	Tensile strength [MPa]	Elongation [%]	Hardness [HRBW]
Specification (NW6022)		≥ 310	≥ 690	≥ 45	—
Specification (UNS N06022)		≥ 310	≥ 690	≥ 45	—
Example	Hot-rolled plate 12mm <sup>t</sup>	367	744	73	84
	Cold-rolled sheet 3mm <sup>t</sup>	383	782	57	86

Corrosion Resistance

Pitting Corrosion Resistance

Alloy	ASTM G48 Method A		ASTM G48 Method C
	22°C	50°C	Critical pitting corrosion temperature CPT (°C)
NAS185N	○	○	70
NAS254N	○	○	80
NASNW22	○	○	>103

Test conditions ASTM G48 Method A (○: No pitting corrosion, x: Pitting corrosion)      ASTM G48 Method C

- Test solution: 6%FeCl<sub>3</sub>
- Test temperature: 22°C, 50°C (Recommended temperature in this test)
- Test time: 72h
- Test solution: 6%FeCl<sub>3</sub> + 1%HCl
- Test time: 72h

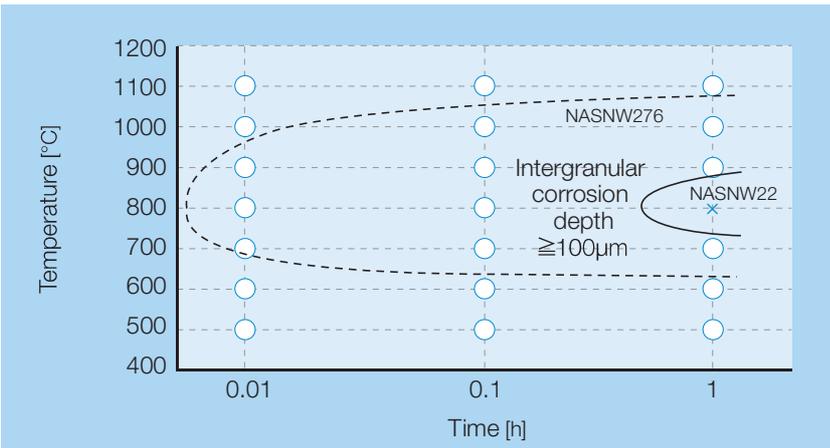
Crevice Corrosion Resistance

Alloy	ASTM G48 Method D
	Critical crevice corrosion temperature CCT (°C)
NAS185N	40
NAS254N	45
NASNW22	>103

Test conditions ASTM G48 Method D

- Test solution: 6%FeCl<sub>3</sub> + 1%HCl
- Test time: 72h

Intergranular Corrosion Resistance



Test conditions: ASTM G28 Method A  
 Test time 24h,  
 boiling 50%H<sub>2</sub>SO<sub>4</sub> - Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> solution

## Stress Corrosion Cracking Resistance

Alloy	MgCl <sub>2</sub> concentration (boiling point (°C) are in brackets)							
	45% (155°C)	42% (143°C)	40% (138°C)	38% (134°C)	35% (126°C)	30% (115°C)	25% (110°C)	20% (108°C)
NAS185N	x	x	x	x	○	○	○	○
NAS254N	x	x	x	○	○	○	○	○
NASNW22	○	○	○	○	○	○	○	○

Test conditions

- Immersion in boiling MgCl<sub>2</sub> solution
- Test time: 300h
- U-bend test specimen is used.

○: No stress corrosion cracking  
x: Stress corrosion cracking

## Acid Resistance

Alloy	Corrosion rate in sulfuric acid at 80°C (mm/y)					
	5%	10%	20%	40%	60%	80%
NAS185N	0.02	0.04	1.32	2.89	3.20	4.78
NAS254N	0.02	0.05	1.02	2.11	2.16	7.76
NASNW22	0.01	0.02	0.02	0.04	0.47	0.34

Test time: 24h

Alloy	Corrosion rate in hydrochloric acid at 80°C (mm/y)			
	0.1%	1%	2%	3%
NAS185N	0.01	0.02	4.20	7.21
NAS254N	0.01	0.02	0.01	9.14
NASNW22	0.02	0.03	0.02	0.04

Test time: 24h

(Reference)

Alloy	JIS	UNS No.	Chemical composition
NAS185N	SUS312L	S31254	20Cr-18Ni-6Mo-0.8Cu-0.2N
NAS254N	SUS836L	S32053	23Cr-25Ni-5.5Mo-0.2N
NASNW22	NW6022	N06022	57Ni-21Cr-14Mo-3W-4Fe

**Workability**

Because the high-temperature strength of NASNW22 is extremely higher than that of Type 304, care is required when hot working. The cold workability of NASNW22 is basically the same as that of standard austenitic stainless steels such as Type 304, Type 316, etc. However, the fact that this is a high strength material must be considered in cold working.

**Weldability**

In welding, it is possible to apply ordinary welding methods in the same manner as with stainless steels. Matching composition welding consumables should be used. Post-weld heat treatment is not required.

**Heat Treatment**

Solution annealing of NASNW22 is normally performed at the temperature range from 1150 to 1170°C followed by being quenched in water or rapidly cooled by other means.

**Pickling**

A mixture of nitric acid and fluoric acid is used in pickling. However, because descaling is somewhat difficult in comparison with Type 304, alkali immersion before acid pickling, and if possible, shot blasting are extremely effective.

**Applications**

Chemical plants, Pharmaceutical plants, Environment-related equipment, Heat exchangers.

**For more information, please contact:**

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