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Stainless Steel 301

Description

SUS301 is a metastable austenitic stainless steel that cannot be strengthened by heat treatment but exhibits the strongest cold work hardening capability among stainless steels. Through cold rolling, its tensile strength can be increased from 520 MPa in the annealed state to over 1500 MPa in the SH state, with hardness rising from HV 200 to over HV 550. This unique property makes it the preferred material for manufacturing high-strength springs, elastic components, and precision instrument parts. Compared to SUS304, SUS301 has a lower nickel content, lower cost, and higher strength, but slightly inferior corrosion resistance and weldability. When using this material, it should be noted that cold working introduces magnetism, and machining can be difficult.

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Datasheet

SUS301 Austenitic Stainless Steel Material Data Sheet

1. Designation System and Standard

Items	Contents
Japanese Standard	JIS G4304 (hot-rolled steel plate),JIS G4305 (cold-rolled steel plate)
Designation meaning	SU-Stainless Steel + S-Steel + 301-AISI designation
Corresponding designations	Chinese Standard: 12Cr17Ni7/U.S. Standard: 301/German Standard: 1.4310/European Standard: X5CrNi17-7
Former designation	1Cr17Ni7 (Obsolete)
Material type	Metastable austenitic stainless steel, readily strengthened by cold deformation

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Datasheet

2. Chemical Composition (%)

Elements	C	Si	Mn	P	S	Cr	Ni	Note
Content	≤0.15	≤1.00	≤2.00	≤0.045	≤0.030	16.0~18.0	6.0~8.0	Low carbon, high chromium and nickel

Key Characteristics: Nickel content of 6–8% (lower than 304 steel's 8–10.5%) and chromium content of 16–18% make SUS301 more prone to martensitic transformation during cold working, resulting in a significant increase in strength.

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Datasheet

3. Physical Properties

Performance parameters	Value	Unit	Note
Density	7.93	g/cm³	Density of standard austenitic stainless steel
Melting range	1398~1420	°C	
Elastic modulus	193	GPa	20°C
Poisson's ratio	0.29	—	
Coefficient of Thermal Expansion	16.0~18.7	×10⁻⁶/℃	0~100°C to 0~500°C
Thermal Conductivity	12.1~21.5	W/(m·K)	20°C to 500°C
Specific heat capacity	0.50	kJ/(kg·K)	0~100°C
Resistivity	0.73	μΩ·m	20°C
Magnetic	Non-magnetic in the annealed state → magnetic after cold working	—	Cold working induces martensitic transformation, resulting in magnetic properties.

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Datasheet

4. Mechanical Properties (Annealed State)

State	Yield strength Rp0.2 (MPa)	Tensile strength Rm (MPa)	Elongation A (%)	Hardness HV	Note
Annealed state (O)	≥205	≥520	≥40	≤200	Fully softened, highly formable.
Typical measured values	240~260	550~620	45~55	180~200	Superior to standard values

Key characteristic: Even in the annealed state, its strength is higher than that of 304 stainless steel, and it exhibits an exceptionally rapid rate of cold work hardening.

5. Cold-Work Hardened States (Key Characteristics)

The most distinctive feature of SUS301 is its ability to achieve exceptionally high strength and hardness through cold rolling. Its hardness levels are classified as follows:

Hardness grade	Vickers hardness HV	Tensile strength Rm (MPa)	Yield strength Rp0.2 (MPa)	Elongation A (%)	Applications
1/4H	250~300	≥750	≥450	≥25	Lightly strengthened, general forming
1/2H	310~360	≥930	≥510	≥18	Medium strength, spring leaf
3/4H	370~420	≥1130	≥745	≥12	High strength, elastic components
H (full hard)	430~480	≥1275	≥930	≥8	High elasticity, precision springs
EH (extra hard)	490~540	≥1420	≥1130	≥5	Very high strength, special springs

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Datasheet

Hardness grade	Vickers hardness HV	Tensile strength Rm (MPa)	Yield strength Rp0.2 (MPa)	Elongation A (%)	Applications
SH (super hard)	≥530~550	≥1500	≥1275	≥3	Maximum strength, elastic components

Hardening mechanism: During cold working, austenite transforms into martensite, resulting in the dual effects of phase transformation strengthening and work hardening.

6. Process Performance

Items	Performance classification	Description
Cold formability	★★★★★ Excellent (annealed state)	Excellent ductility in annealed state, suitable for deep drawing and bending
Cold work hardening capacity	★★★★★ Excellent	Strongest hardening effect among stainless steels, strength can be increased by 3 times
Weldability	★★★★☆ Good	Requires controlled heat input, annealing recommended after welding
Machinability	★★☆☆☆ Poor	Severe work hardening, requires sharp cutting tools
Corrosion resistance	★★★★☆ Good	Slightly lower than 304 steel, but still resistant to atmosphere and mild corrosive media
Heat resistance	★★★☆☆ Moderate	Long-term service temperature ≤300°C
Heat treatment	—	Not heat-treatable, only solution treatment + cold work hardening are applicable

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7. Characteristics and Applications

Core characteristics	Typical applications
Ultra-high strength after cold working (≥1500 MPa at SH state)	Precision springs, power springs, elastic washers
High elastic modulus (193 GPa)	Spring leaves, diaphragms, bellows, pressure sensors
Magnetic after cold working	Electromagnetic components, relay armatures
Excellent fatigue resistance	Automotive seatbelt retractors, engine springs
High surface quality	Mobile phone antennas, electronic connectors, precision instruments
Lower cost compared to 304 steel	Substitute for 304 steel in high-strength applications

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Datasheet

8. Cross reference of Domestic and International Designations

Standard system	Designation	Standard No.	Note
Chinese standard	12Cr17Ni7	GB/T 20878	New designation
U.S. standard	301	ASTM A240	UNS S30100
Japanese standard	SUS301	JIS G4304/G4305	Primary standard
German standard	1.4310 / X10CrNi18-8	DIN 17440	
European standard	X5CrNi17-7 / 1.4310	EN 10088	