HYDROGENIUS
水素材料先端科学研究センター

DOI: 10.48708/6771915

HYDROGENIUS DATABASE

— SSRT Properties —

No. A81

Database on Slow Strain Rate Test (SSRT) Properties of Hydrogen-Charged JIS-SNCM439 Nickel Chromium Molybdenum Steel in 115 MPa Hydrogen Gas

2021

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Year of publication: 2021

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1. MATERIALS

Table 1 Production process and related data of SNCM439.

Heat	Production process	Product form	Dimensions
G[1)]	Hot-rolled	Plate	Length: 834 mm Width: 130 mm Thickness: 30 mm

1) Reported by the manufacturer.

Table 2 Chemical composition of SNCM439.

	Heat		Element (mass %)							
			C	Si	Mn	P	S	Ni	Cr	Mo
Product analysis	G[1)]		0.40	0.22	0.80	0.014	0.002	1.80	0.86	0.26
Ladle analysis	G[2)]		0.39	0.22	0.79	0.016	0.002	1.80	0.84	0.26
	Requirement[3)]	max	0.43	0.35	0.90	0.030	0.030	2.00	1.00	0.30
		min	0.36	0.15	0.60			1.60	0.60	0.15

1) Performed by HYDROGENIUS.
2) Reported by the manufacturer.
3) JIS G 4053 (2008), “Low-alloyed steels for machine structural use”.

Table 3 Heat treatment condition of SNCM439.

Heat	Shape	Quenching	Tempering
G[1)]	Plate	850°C/2 h, Oil-quenched	640°C/4 h, Air-cooled

1) Reported by the manufacturer.

2. MECHANICAL PROPERTIES

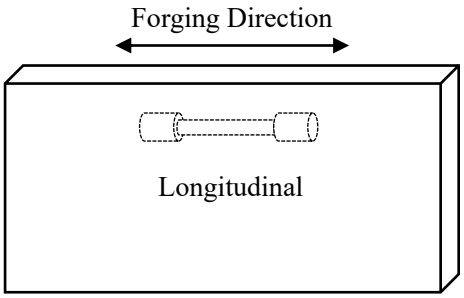
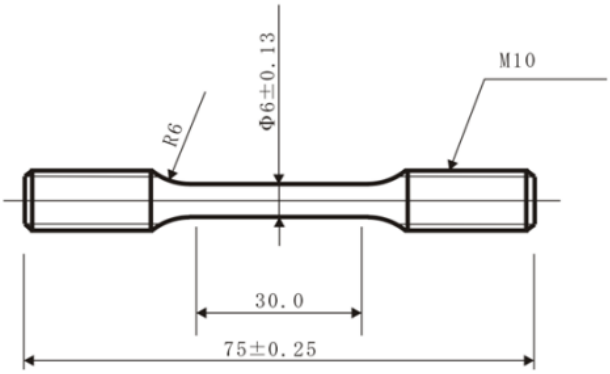
Table 4 Mechanical properties of SNCM439.

Heat	Shape	Tensile Properties				Vickers hardness (*HV*)
		Upper yield strength σ_{UY} (MPa)	Tensile strength σ_B (MPa)	Fracture elongation ε_f (%)	Reduction of area φ (%)	
G[1)]	Plate	734	873	23	66	270
Requirement[2)]	max					
	min	885	980	16	45	

1) Performed by HYDROGENIUS.
2) JIS G 4053 (2008), “Low-alloyed steels for machine structural use”.

3. SSRT PROPERTIES

Table 5 SSRT conditions.

Type and capacity of testing machine	Servo-hydraulic, 100 kN	Screw type, 100 kN
Loading condition	Uniaxial, Monotonic	
Environment	In 115 MPa hydrogen gas at RT	In air at RT
Gas purity	Hydrogen gas: 99.999% (5N)	---
Test speed	2.0×10^{-3} mm/s[2] (6.7×10^{-5} s^{-1})[3]	
Specimen[1]	 (a) Sampling of specimen  (b) Shape and dimensions of specimen (in mm)	

1) Specimen surface was finished by longitudinal polishing with diamond paste.
2) Test speed was determined by crosshead speed.
3) Estimated from crosshead speed divided by the length of parallel section, i.e. the value of 6.7×10^{-5} s^{-1} is given by (2.0×10^{-3} mm/s) / 30 mm.

Table 6　Conditions of hydrogen-charging.

Hydrogen exposure	Specimen was exposed to hydrogen gas environment as shown by the figure below.
Hydrogen gas purity	99.999% (5N)
Schematic profiles of hydrogen pressure and temperature