

Duplication is prohibited. 複製禁止



DOI: 10.48708/4756070

# HYDROGENIUS DATABASE

## — Microstructures —

No. A72

Microstructures of JIS-SNCM439 Low-Alloy Steel

2017

Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS)  
Kyushu University - JAPAN

Duplication is prohibited. 複製禁止

## HYDROGENIUS DATABASE No. A72

### Microstructures of JIS-SNCM439 Low-Alloy Steel

Year of publication: 2017

Kyushu University

HYDROGENIUS

Fatigue and Fracture Department

MATSUOKA Saburo (Leader)

MATSUNAGA Hisao

YAMABE Junichiro

HAMADA Shigeru

TAKAKUWA Osamu

OKAZAKI Saburo

AWANE Tohru

YOSHIKAWA Michio

NAKAMURA Masami

HYDROGENIUS

SUGIMURA Joichi (Director)

NISHI Takayuki (Vice-Director)

Technical Advisory Committee

TAKAKI Setsuo (Chair - Kyushu University)

EGUCHI Tohru (Suzuki Motor Corp.)

HATANO Masaharu (Nippon Steel & Sumikin Stainless Steel Corp.)

HIROTANI Ryuichi (Iwatani Corp.)

IYAMA Akihiro (Nissan Motor Co., Ltd.)

IMAKAWA Kazunari (Nisshin Steel Co., Ltd.)

KANEZAKI Toshihiko (Honda R&D Co., Ltd.)

KAWAMURA Nobuyuki (HAMAI INDUSTRIES LTD.)

KIMURA Kiyoshi (TATSUNO Corp.)

KISHI Kenji (TOKICO TECHNOLOGY LTD.)

KUBOTA Kazumasa (Aichi Steel Corp.)

MAEDA Takashi (JRCM)

MIYAGAWA Kazuo (Honda R&D Co., Ltd.)

MIYAKANE Hirotake (AIR LIQUIDE Japan Ltd.)

NANBA Shigenobu (Kobe Steel, Ltd.)

OHMURA Tomohiko (Nippon Steel & Sumitomo Metal Corp.)

SHINOHARA Mikiya (Nissan Motor Co., Ltd.)

TAKAGI Shusaku (JFE Steel Corp.)

TAKAMI Masayoshi (Toyota Motor Corp.)

TANAKA Hidenori (YAMATO)

WATANABE Osamu (KITZ CORP.)

YAMAGUCHI Norikazu (Taiyo Nippon Sanso Corp.)

YAMAMOTO Hiroshi (Azbil Corp.)

YAMAMOTO Osamu (Toyota Motor Corp.)

YANAGISAWA Yusuke (The Japan Steel Works, Ltd.)

YOSHIKAWA Nobuhiro (University of Tokyo)

YOSHINAGA Tomofumi (Nissan Motor Co., Ltd.)

Users' acceptance of these terms: This HYDROGENIUS DATABASE is available without charge on these express terms that users who view, access, download to use this HYDROGENIUS DATABASE expressly agree to these terms of use indicated herein. If you do not accept these terms, you must not access, view or download to use for any purpose.

Disclaimer: Unless otherwise stated, any products designed and/or fabricated in accordance with this HYDROGENIUS DATABASE are neither endorsed by nor affiliated with HYDROGENIUS. To the extent permitted by laws of Japan, HYDROGENIUS excludes, whether express or implied, all conditions, warranties, representations or other terms which may apply to this HYDROGENIUS DATABASE or any content on it. HYDROGENIUS will not be liable for any direct or indirect losses/damages of any consequence resulting from, whether in contract, tort (including negligence), breach of statutory duty or otherwise whether foreseeable or not, or arising under or in connection with use of or reliance on this HYDROGENIUS DATABASE and any content displayed on this HYDROGENIUS DATABASE, or for inability to use this HYDROGENIUS DATABASE thereon. There are no express or implied warranties of merchantability or fitness for a particular purpose regarding the use of this HYDROGENIUS DATABASE and any content displayed on this HYDROGENIUS DATABASE.

All rights reserved: No part of this HYDROGENIUS DATABASE or any of content displayed on HYDROGENIUS DATABASE may be reproduced or republished in any format, stored in any electronic or alternative retrieval system, or else modified, transferred, distributed, circulated, transmitted or exploited in any manner, without the prior written permission of HYDROGENIUS. All company and product names, design rights and equipment that are featured, used or cited in this HYDROGENIUS DATABASE shall remain any of intellectual property and/or registered trademarks of their respective companies/owners.

Termination: HYDROGENIUS reserves the rights to modify this HYDROGENIUS DATABASE in any way or discontinue providing any or all of this HYDROGENIUS DATABASE without notice. HYDROGENIUS may require the termination of any and all display distribution or other use of any or all of this HYDROGENIUS DATABASE for any reason.

Duplication is prohibited. 複製禁止

These terms of use, its subject matter and formation are governed by the laws of Japan, and the courts of Japan will have exclusive jurisdiction in case of dispute or claims related to this HYDROGENIUS DATABASE.

Any personal information or data collected from your access to this HYDROGENIUS DATABASE will be handled according to the policy of Kyushu University Institution Repository (QIR) and Privacy Policy of Kyushu University which can be found at <https://www.kyushu-u.ac.jp/en/website/privacypolicy>.

Copyright © 2021

Kyushu University, Research Center for Hydrogen Industrial Use and Storage (HYDROGENIUS)

744 Motoooka, Nishi-ku, Fukuoka-city, Fukuoka, 819-0395, JAPAN

Tel.: +81-92-802-3921 Fax: +81-92-802-3928

E-mail: [db@hydrogenius.kyushu-u.ac.jp](mailto:db@hydrogenius.kyushu-u.ac.jp)

## Microstructures of JIS-SNCM439 Low-Alloy Steel

### 1. MATERIALS

Table 1. Details of processing and related data of SNCM439.

Heat	Production Process	Product Format	Dimensions (mm)
A <sup>1)</sup>	Hot-rolled	Plate	Length: 870 mm Width: 131 mm Thickness: 31 mm
G <sup>1)</sup>	Hot-rolled	Plate	Length: 834 mm Width: 130 mm Thickness: 30 mm
J <sup>1)</sup>	Hot-forged	Cylinder	Length: 3630 mm Outer diameter: 320 mm Inner diameter: 200 mm Thickness: 60 mm

<sup>1)</sup> As reported by the manufacturer.

Table 2. Chemical composition of SNCM439.

	Heat	Element (mass%)							
		C	Si	Mn	P	S	Ni	Cr	Mo
Product Analysis	A <sup>1)</sup>	0.43	0.22	0.82	0.012	0.002	1.81	0.86	0.25
	G <sup>1)</sup>	0.40	0.22	0.80	0.014	0.002	1.80	0.86	0.26
	J <sup>1)</sup>	0.40	0.27	0.89	0.009	0.015	1.84	0.92	0.28
Ladle Analysis	A <sup>2)</sup>	0.43	0.22	0.82	0.016	0.002	1.80	0.86	0.26
	G <sup>2)</sup>	0.39	0.22	0.79	0.016	0.002	1.80	0.84	0.26
	J <sup>3)</sup>	0.42	0.26	0.80	0.010	<0.010	1.91	0.89	0.25
	Requirements <sup>4)</sup>	Max.	0.43	0.35	0.90	0.030	0.030	2.00	1.00
Min.		0.36	0.15	0.60			1.60	0.60	0.15

<sup>1)</sup> As performed by HYDROGENIUS.

<sup>2)</sup> As reported by the manufacturer.

<sup>3)</sup> After issuance of the inspection certificate.

<sup>4)</sup> As per JIS G 4053:2008, "Low-alloyed steels for machine structural use".

Table 3. Heat-treatment conditions for SNCM439.

Materials	Heat	Shape	Quenching	Tempering
Large-sized material	A <sup>1)</sup>	Plate	850°C/2 h, Oil-quenching	650°C/4 h, Air-cooling
	G <sup>1)</sup>	Plate	850°C/2 h, Oil-quenching	640°C/4 h, Air-cooling
	J <sup>1)</sup>	Cylinder	860°C, Water-spraying	620°C, Air-cooling
			850°C/2 h, Oil-quenching <sup>4)</sup>	650°C/4 h, Air-cooling <sup>4)</sup>
Small-sized material	J <sup>2)</sup>	Near net shape of specimen <sup>3)</sup>	845°C/30 min, Oil-quenching	550°C/60 min, Water-cooling 600°C/60 min, Water-cooling 650°C/60 min, Water-cooling

<sup>1)</sup> As reported by the manufacturers.

<sup>2)</sup> As performed by HYDROGENIUS.

<sup>3)</sup> See Table 4.

<sup>4)</sup> A block of  $l = 108$  mm,  $w = 320$  mm and  $t = 60$  mm was heat-treated.

## 2. MICROSTRUCTURES

Table 4. Microstructural observation conditions.

Surface preparation	Optical microscope image	Etching with nital (Ethanol solution of 3% nitric acid) Etching with picral (Ethanol saturated with picric acid)
	SEM (Scanning Electron Microscope) image	Etching with nital
	EBSD (Electron Backscatter Diffraction) image	OPS (Colloidal silica solution) Acceleration voltage: 15 kV

Sampling

