

TCA-IN100

Vacuum-Cast Nickel-Base Superalloy | Alloy IN100 | AMS 5397 | UNS N13100

Overview

TCA-IN100 is TCA's vacuum-cast version of Alloy IN100 (also written IN-100), a nickel-base superalloy strengthened primarily by precipitation of the coherent γ' phase, $\text{Ni}_3(\text{Al,Ti})$. Its high combined aluminum and titanium content gives it excellent stress-rupture strength up to 1050 °C, while its relatively low density offers an advantage in strength-to-weight ratio. The high cobalt content lowers the stacking-fault energy of the face-centered cubic matrix, contributing to good stability at high temperature.

IN100 is designed for components that must carry high loads at elevated temperature for long periods. It has been used successfully for turbine blades, vanes and nozzles of complex shape, and as a die material for the isothermal forging of titanium alloys and nickel-base superalloys.

TCA produces near-net-shape TCA-IN100 investment castings directly from the customer's CAD data, using master alloy melted in-house, with material conforming to AMS 5397. The nominal chemical composition is given in Table 1.

Key Features

- γ' -strengthened nickel-base superalloy, vacuum investment cast
- Peak tensile strength at about 800 °C (UTS 938 MPa)
- Stress-rupture life of 39.7 h at 980 °C / 200 MPa — about 1.7× the AMS 5397 minimum of 23 h
- Near-net-shape castings made directly from customer CAD files

Table 1 – Nominal Composition (wt.%)

Element	wt.%
Carbon	0.17
Manganese	<0.10
Silicon	<0.10
Phosphorus	<0.015
Sulfur	<0.015
Chromium	9.50
Cobalt	15.00
Molybdenum	3.00
Titanium	4.75
Aluminum	5.50
Boron	0.015
Vanadium	0.95
Zirconium	0.06
Iron	<1.00
Nickel	Bal.

* Conforms to AMS 5397

Table 2 – Physical Properties

Property	Value
Density, g/cm ³	7.75
Melting range, °C	1270 – 1337
Melting range, °F	2318 – 2439
Linear thermal expansion coefficient, 10⁻⁶/°C	
RT – 427 °C	11.6
RT – 871 °C	13.5
RT – 1093 °C	15.4

Typical values; they vary slightly from heat to heat with composition.

Mechanical Properties

TCA-IN100 is distinguished by its excellent mechanical properties at high temperature, including tensile and stress-rupture strength. All mechanical data in this brochure were measured on as-cast TCA-IN100 specimens.

Tensile Properties

Tensile tests were performed in accordance with ASTM E8/E8M. TCA-IN100 combines high tensile and yield strength at room temperature with a further gain in strength as temperature rises, reaching a peak at about 800 °C (UTS 938 MPa, YS 833 MPa); strength falls off rapidly above this temperature. The results are listed in Table 3, and the temperature dependence of the tensile properties is plotted in Fig. 1.

Table 3 – Tensile properties of as-cast TCA-IN100

Temperature °C	Temperature °F	Tensile strength MPa	Yield strength MPa	Elongation %
25	77	816	711	7.0
500	932	864	740	8.6
600	1112	881	763	9.6
700	1292	915	778	9.6
800	1472	938	833	9.0
900	1652	765	590	8.0
1000	1832	499	386	8.0
1100	2012	246	198	3.0

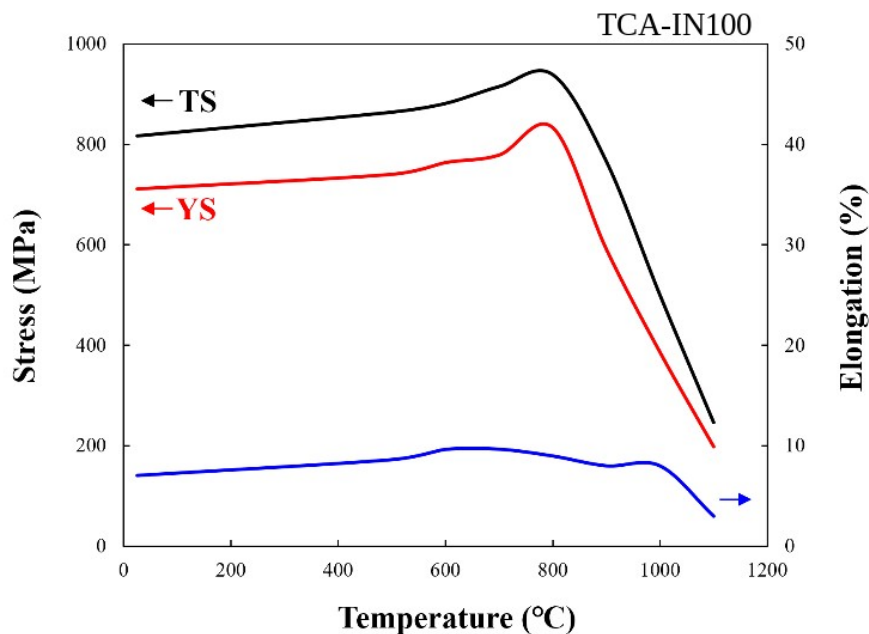


Fig. 1 – Temperature dependence of the tensile properties of as-cast TCA-IN100

Stress-Rupture Properties

The stress-rupture performance of TCA-IN100 is verified against AMS 5397. Under this specification, a specimen held at 1800 ± 3 °F (982 ± 2 °C) under a load producing an initial axial stress of 29.0 ksi (200 MPa) or higher, applied continuously, shall not rupture in less than 23 hours. The test is continued to rupture without change of load, and the elongation after rupture, measured at room temperature, shall be not less than 4% in 4D.

Stress-rupture tests were conducted in accordance with ASTM E139. As shown in Table 4 and Fig. 2, as-cast TCA-IN100 tested at 980 °C / 200 MPa ruptured after 39.7 h with an elongation after rupture of 12.6% — comfortably exceeding both AMS 5397 requirements.

Table 4 – Stress-rupture results vs. AMS 5397 requirements

Item	AMS 5397 requirement	TCA test result
Test temperature	1800 ± 3 °F (982 ± 2 °C)	980 °C
Initial axial stress	≥ 29.0 ksi (200 MPa)	200 MPa
Rupture life	≥ 23 h	39.7 h
Elongation after rupture (RT)	$\geq 4\%$ in 4D	12.6%

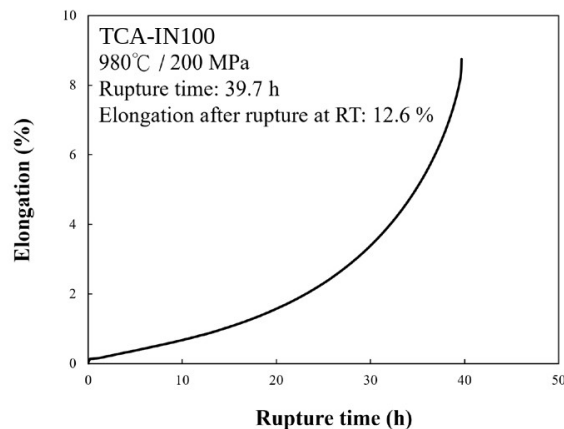


Fig. 2 – Stress-rupture curve of as-cast TCA-IN100 at 980 °C / 200 MPa

Typical Applications

- Turbine blades, vanes and nozzles of complex shape
- Hot-section parts under sustained high load
- Isothermal forging dies for Ti and Ni-base alloys

Why TCA

- Ni- & Co-base superalloy caster since 1984
- Near-net-shape vacuum investment castings
- In-house master alloy, supplied to AMS specs
- ISO 9001 / AS9100D and ISO/IEC 27001 certified
- ISO/IEC 17025 accredited laboratory (TAF No. 4378)

Send us your CAD files for a quotation: info@tcaic.com | www.tcaic.com

The data in this publication were obtained from tests on as-cast TCA-IN100 specimens and are representative values for reference only; they are not guaranteed minimums or design allowables. TCA-IN100 is produced by TCA from master alloy melted in-house. Generic alloy designations are used for identification purposes only.
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