

ALLOY 100, UNS K92580, AERMET 100

- ✓ Aircraft landing gear (F-35, Boeing 787)
- ✓ High-stress fasteners & engine components
- ✓ Armor plating & missile casings

Chemical Composition

Grade	Chemical composition WT %												
	C	Si	Mn	P	S	Cr	Ni	Mo	W	V	Ti	B	

Mechanical Properties

Room Temperature Performance

Property	Value	Test Standard
Tensile Strength	1930-2070 MPa (280-300 ksi)	ASTM E8/E8M
Yield Strength	1650-1790 MPa (240-260 ksi)	ASTM E8/E8M
Elongation	10-14%	ASTM E8/E8M
Fracture Toughness (KIC)	110-130 MPa√m	ASTM E399
Hardness	52-54 HRC	ASTM E18

Fatigue Performance (S-N Curve)

- Fatigue limit (10⁷ cycles, R=0.1): 700-750 MPa
- High-cycle fatigue (HCF): Dominated by microcrack initiation at inclusions
- Low-cycle fatigue (LCF): Controlled by plastic strain accumulation

Fatigue Crack Growth Rate (Paris Law Parameters)

Stress Ratio (R)	C (mm/cycle)	m	ΔK Range (MPa√m)
R=0.1	1.2×10 ⁻¹¹	3.2	10-50
R=0.5	3.5×10 ⁻¹¹	3.0	10-40

Fracture Toughness & CTOD Analysis

Crack Tip Opening Displacement (CTOD)

- **Critical CTOD (δ_m): 0.15-0.25 mm** (ASTM E1820)
- **Threshold ΔK_{th} : $\sim 5 \text{ MPa}\sqrt{\text{m}}$** (below which cracks do not propagate)

Fracture Modes

- **Fatigue fracture:** Striations + secondary cracks
- **Overload fracture:** Dimples + localized cleavage (hydrogen embrittlement risk)

Microstructure Analysis (SEM/TEM/EBSD)

Key Phases in AerMet 100

Phase	Morphology	Size
Lath Martensite	High-dislocation-density bundles	0.2-0.5 μm width
Reversed Austenite	Thin films between laths	10-50 nm thickness
M2C Carbides	Spherical precipitates	5-20 nm diameter

Fractography (SEM Imaging)

- **Crack initiation:** Often at **Al_2O_3 inclusions ($\leq 10 \mu\text{m}$)**
- **Stable crack growth:** Fatigue striations ($\sim 1 \mu\text{m}/\text{cycle}$ spacing)
- **Fast fracture:** Mixed ductile (dimples) + brittle (cleavage)

6. Environmental Effects & Special Conditions

Hydrogen Embrittlement (SSRT Testing)

- **Reduction in ductility:** 14% $\rightarrow$ 6% **elongation** (after H-charging)
- **Fracture mode shift:** Ductile $\rightarrow$ **intergranular cracking**

Corrosion Fatigue (Salt Spray Testing)

- **Fatigue life reduction:** **30-40%** in 3.5% NaCl vs. dry air
- **Crack growth acceleration:** **2-3 $\times$ faster** at $\Delta K > 15 \text{ MPa}\sqrt{\text{m}}$

Physical Properties

1. **Solution Treatment:** 885-925 $^{\circ}\text{C}$ (oil quench)
2. **Aging:** 455-495 $^{\circ}\text{C}$ for **4-8 hours** (air cool)

Heat Treatment



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References - Datasheet

Revised: 2025-08-15

UpDtae: 2025-08-15

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2. **Aging:** 455-495°C for **4-8 hours** (air cool)

Welding Properties

- **Welding:** Avoid conventional methods—**EBW/LBW + PWHT required**

Machining Properties

- **Machining:** Use **carbide tools**, low speeds, high feed rates

<https://longhaisteel.com>