

Castable Nb-Mo-C Eutectic Superalloy for Ultrahigh Temperature Applications

Tech ID: 34873 / UC Case 2026-963-0

ABSTRACT

Researchers at the University of California, Davis have developed nano-eutectic niobium-based superalloys designed for exceptional strength, ductility, and stability at ultrahigh temperatures up to 1500°C.

FULL DESCRIPTION

This technology involves niobium (Nb)-based eutectic superalloys incorporating molybdenum (Mo) and carbon (C), engineered to sustain mechanical performance at temperatures up to 1500°C. These alloys feature a nano-eutectic lamellar microstructure that remains thermodynamically stable beyond 2200°C, offering superior high-temperature strength while retaining room-temperature tensile ductility. Unlike existing Nb alloys, they overcome key thermal and mechanical limitations with improved strength retention, strain hardening, and microstructural stability suitable for use in hypersonic systems, propulsion, and advanced aviation. The alloys can be fabricated via casting or other production methods from elemental feedstock and may include additional alloying elements to optimize performance.

APPLICATIONS

- ▶ Hypersonic and high-speed aerospace propulsion components.
- ▶ Advanced aviation structural materials requiring ultrahigh temperature capability.
- ▶ High-temperature industrial equipment and turbines.
- ▶ Additive manufacturing and casting of refractory alloy parts.
- ▶ Energy systems operating at extreme temperatures.

FEATURES/BENEFITS

- ▶ Retains high-temperature strength and maintains thermodynamic stability.
- ▶ No microstructural coarsening measured at 1400 °C for 100 hours.
- ▶ Possesses room-temperature tensile ductility and is free of embrittlement and solute segregation at grain interior and grain boundaries.
- ▶ Delivers superior high-temperature strength via a nano-eutectic microstructure.
- ▶ Reduces weight through and comparatively low density versus heavier refractory alloy systems.
- ▶ Enables cost-effective production by allowing casting from bulk elemental feedstock.
- ▶ Overcomes the operating-temperature limits of current Ni-based superalloys and Nb-based alloys.
- ▶ Closes the ultrahigh-temperature strength–ductility performance gap in existing high-temperature materials.

CONTACT

Andrew M. Van Court
amvancourt@ucdavis.edu
 tel: .



INVENTORS

- ▶ Nahin, Ayeman
- ▶ Zhang, Mingwei

OTHER INFORMATION

KEYWORDS

aerospace, alloy casting,
 high-temperature alloys,
 hypersonic systems,
 niobium alloys, refractory
 metals, superalloys,
 ultrahigh temperature,
 wear resistance

CATEGORIZED AS

- ▶ **Materials & Chemicals**
- ▶ Other

RELATED CASES

2026-963-0

► Prevents the brittleness and brittle “bulky” phase formation (Nb₃Si) observed in earlier Nb–Si eutectic alloys.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

► [Low-cost Niobium-based Alloy for Ultrahigh Temperature Applications](#)

University of California, Davis Technology Transfer Office 1 Shields Avenue, Mrak Hall 4th Floor, Davis,CA 95616	Tel:		© 2026, The Regents of the University of California
	530.754.8649		Terms of use
	techtransfer@ucdavis.edu		Privacy Notice
	https://research.ucdavis.edu/technology-		
	transfer/		
	Fax:		
	530.754.7620		