

Low-cost Niobium-based Alloy for Ultrahigh Temperature Applications

Tech ID: 34645 / UC Case 2026-446-0

ABSTRACT

Researchers at the University of California, Davis have developed a refractory niobium-based complex concentrated alloy designed for exceptional strength and durability at ultrahigh temperatures with a significantly reduced material's cost.

FULL DESCRIPTION

This technology introduces a novel niobium-based refractory complex concentrated alloy composed primarily of niobium, tantalum, titanium, and vanadium in specific atomic proportions, engineered to deliver superior mechanical performance at temperatures meeting or exceeding C-103 and conventional nickel-based superalloys. The alloy features a body-centered cubic crystal structure and exhibits high yield and tensile strengths at room temperature and elevated temperatures up to 1300°C, combined with improved specific strength and structural stability.

APPLICATIONS

- ▶ Gas turbine engine components, including turbine blades.
- ▶ Aerospace structural parts requiring high-temperature durability.
- ▶ Energy sector equipment exposed to extreme thermal and mechanical conditions.
- ▶ Advanced manufacturing of refractory alloy-based structural components.

FEATURES/BENEFITS

- ▶ Withstands ultrahigh temperatures.
- ▶ Provides superior 0.2% offset yield strength.
- ▶ Maintains outstanding ultimate tensile strength at elevated temperatures.
- ▶ Reduces costs by minimizing reliance on expensive elements such as hafnium through optimized alloy composition.
- ▶ Achieves a strong balance between strength and ductility, overcoming limitations of traditional RCCAs.
- ▶ Enhances structural integrity with a single-phase body-centered cubic crystal structure.
- ▶ Lowers component weight with reduced density.
- ▶ Surpasses temperature limitations of nickel-based superalloys in high-temperature turbine and aerospace applications.
- ▶ Resolves cost and strength issues present in niobium alloys containing hafnium.
- ▶ Improves ductility and formability compared to many other high-strength refractory complex concentrated alloys.

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OTHER INFORMATION

KEYWORDS

aerospace, complex concentrated alloy, high-temperature alloy, niobium alloy, refractory metals, refractory complex concentrated alloys, superalloys, turbine engines, ultrahigh temperature materials, vanadium

CATEGORIZED AS

- ▶ **Energy**
- ▶ Other
- ▶ **Engineering**
- ▶ Engineering
- ▶ **Materials & Chemicals**

PATENT STATUS

Patent Pending

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