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Brief 68-10344

NASA TECH BRIEF

Nickel Base Alloy with Improved Stress Rupture Properties

The problem:

The need for a superalloy material for jet aircraft turbine blades providing a substantial improvement in stress rupture life over present-day alloys.

The solution:

A nickel base superalloy of the following weight percent composition: 0.13 C, 6.1 Cr, 2.0 Mo, 1.0 Ti, 5.4 Al, 7.5 Co, 5.8 W, 0.5 Re, 0.43 Hf, 0.13 Zr, 0.02 B, 9.0 Ta, 0.5 Cb, and the balance Ni. This alloy is capable of maintaining its strength and its creep, oxidation, and thermal fatigue resistance at high temperature.

How it's done:

A nickel base superalloy has been developed that is particularly adapted for use in turbine engine blades because of its excellent stress rupture properties and other physical characteristics. The alloy, designated "Alloy VI A," (composition cited above), has attractive high temperature properties and compares favorably with all known commercially available, nickel base alloys—for example, at 2000° F and at an applied stress of 15,000 psi, the average stress rupture life is 63 hours.

The alloy uses substantial amounts of solid solution strengtheners such as tantalum, tungsten, and molybdenum in proper balance to achieve strength properties without depreciating oxidation resistance. The nickel, aluminum, and titanium contents, for best results, must also be controlled. The addition of rhenium is used to improve strength and corrosive properties of the alloy. The stress rupture life of the alloy is generally more than that of currently-used superalloys.

Notes:

1. Alloy VI A provides a higher use temperature than the strongest present-day commercially available high strength nickel base alloys.
2. Tensile strength and impact properties are comparable to current alloys and ductility appears adequate.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B68-10344

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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