CINDAS LLC
www.cindasdata.com

Industry Benchmark for Critically Evaluated Materials Properties Data

Now available on-line—CINDAS Aerospace and High Performance Alloys Database (AHAD)

The AHAD web-based database is a combined version of the popular CINDAS products, the Aerospace Structural Metals Database (ASMD) and the High Performance Alloys Database (HPAD). It contains 298 alloys with over 19,300 PDF pages of text, tables and figures, 11,000 references, 28,000 datasets, and nearly 100,000 data curves. The user friendly interface enables AHAD subscribers to quickly select and compare the attributes of the alloys for which they are looking.

The AHAD provides numeric and graphic information as part of the database, including a comprehensive PDF consisting of additional information for each alloy.

AHAD Users

Universities	Course Material Aid
Technical Schools	Project Reference & Guide
Government Agencies	New Material Research
Aerospace Industry	Turbine Design
Automotive Industry	Developing Engines & Frame
Industrial Suppliers	Manufacturing/Machinery
Research Corporations	Research & Development

And many others...

About the Data

The database contains the same data as the HPAD and the ASMD in one convenient location so customers needing information contained in both of those popular products have only to search a single database.

Search and Browse the Aerospace and High Performance Alloys Database by

Material Group
(Aluminum, Titanium, Nickel Alloys, Stainless Steels, etc.)
Material Name
(Al6061, Ti-6Al-4V, Inconel 706, etc.)
Property Group
(Mechanical, Thermophysical, etc.)
Property Name
(Yield Strength, Elongation, Fracture Toughness, Corrosion Rate, etc.)

Property Groups

The AHAD contains 705 different properties. These properties are separated into 20 easy-to-navigate property groups. Alternatively, you can search the property names by using keywords which would bring you directly to the property you're interested in.

Thermophysical

Thermoradiative

Electrical and Nuclear

Mechanical Properties

> Strength, Stress, Hardness, Fatigue & Crack Growth, Impact Energy, Strain, Area Reduction, Deformation and others

Temperature

Time, Life to Failure

Corrosion, Oxidation, and Weight Change

Length, Thickness, Diameter, Size, and Grain Size

Content of Component, Phase

Plus others...

Purdue Technology Center-Aerospace, 1801 Newman Road, Suite 104B, West Lafayette IN 47906-4510 USA
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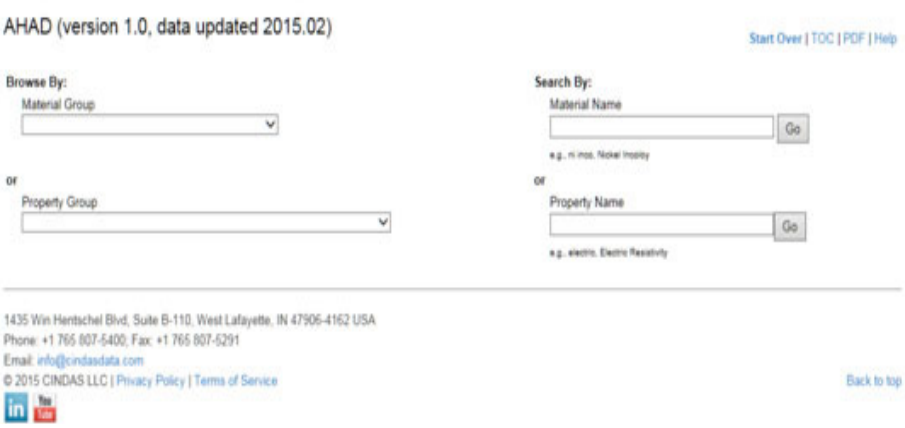
August 2018

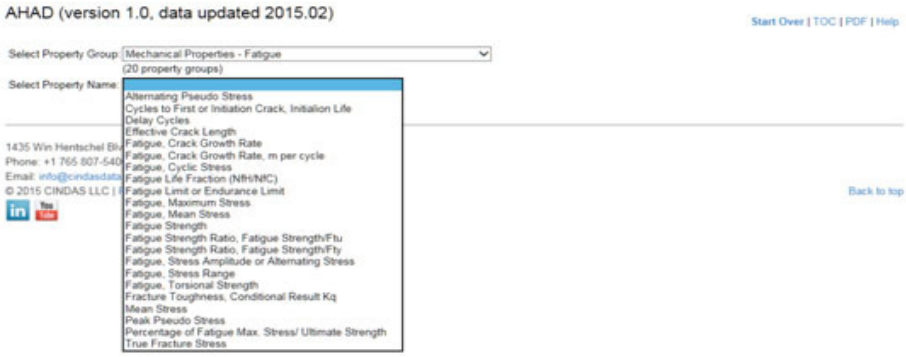
Searching and Browsing:
Aerospace and High Performance Alloys Database (AHAD)
Finding Information

Search: Enter the full or partial name of the property or material.

Browse: Use the drop-down menu to find the property or material.

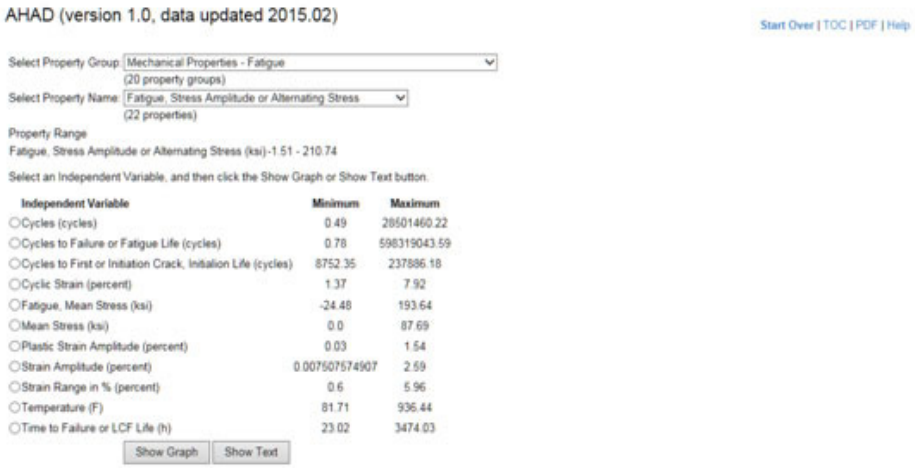
The Aerospace and High Performance Alloys Database contains 298 metal alloys in 21 metal groups and 705 properties in 20 property groups.





Customizing Information

Select: The independent variable.



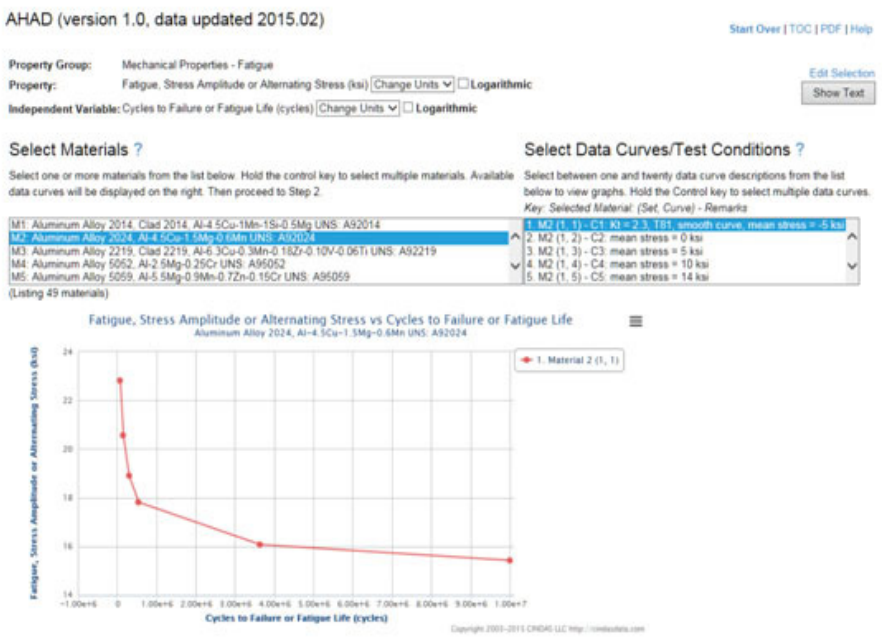
Viewing Information

The AHAD allows the user to view a property of multiple materials on one graph.

Step 1: Select Materials.

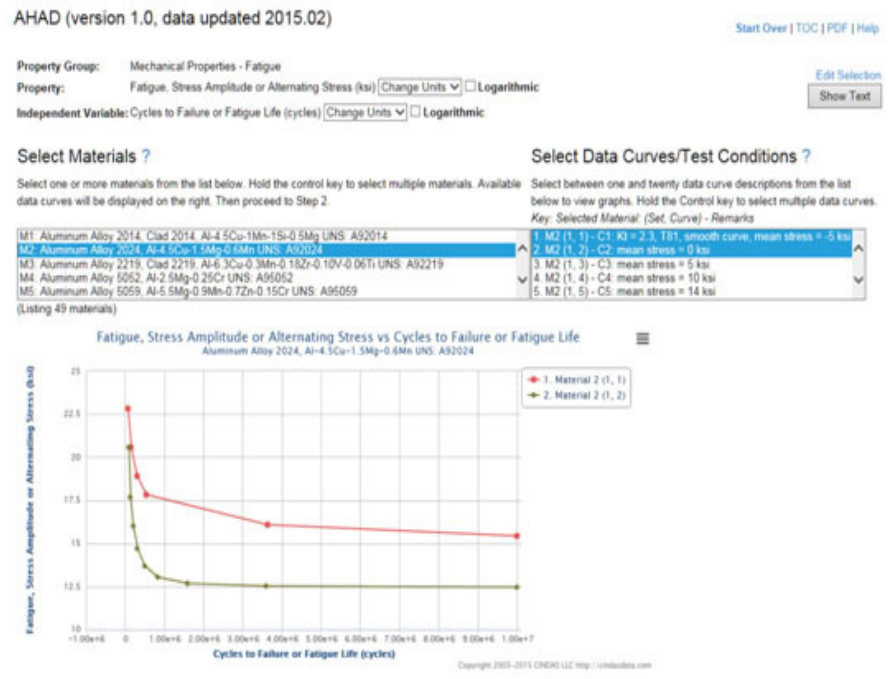
Step 2: Select Data Curves or Test Conditions.

Note: At any time, the user can click on the "Show Text" button to see the values of the data points, text description, references, etc.



Results: Graphic and Numeric

- Nearly 100,000 data curves
- Color-coded data curves
- Multiple curves of different materials per graph
- Hovering cursor to show X and Y values of each data point
- Unit conversion package
  - Contains both English and SI units
  - Shows all typically used units for the variables
  - Allows both X-axis and Y-axis selection



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Materials Cross Index

The materials cross index contains the commercial and alternative designations for all the metal alloys in the database. This feature can be used to find the correct metal alloy when only the trade name or commercial designation is available.

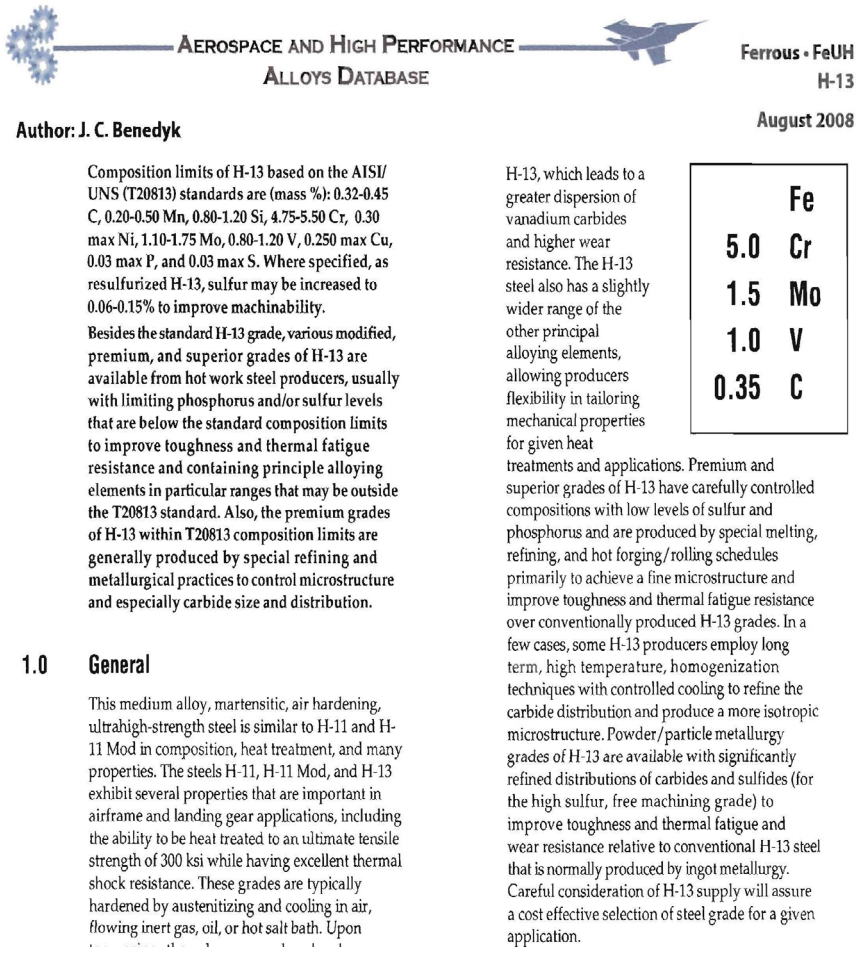
MCode	MName	Commercial and Alternate Designations
1201	High Strength Steel 4130	4130; AISI 4130; SAE 4130; 4130H; UNS G41300;
1203	High Strength Steel 4140	4140; AISI 4140; SAE 4140; 4140H; UNS G41400;
1204	High Strength Steel 4330V	4330V; 4330; 4330 Mod; 4330V Mod; 4330V (Mod
1206	High Strength Steel 4340	4340; AISI 4340; SAE 4340; E 4340; 4340 H; UNS
1208	High Strength Steel 8630	8630; AISI 8630; SAE 8630; 8630H; UNS J13042;
1218	High Strength Steel H-11 Mod	H-11 Mod; AISI Type H-11; SAE Type H-11; UNS
1225	High Strength Steel 18Ni (300) Maraging	18Ni Maraging Steel; 18Ni-Co-Mo; 18-9-5; Vascom
1228	High Strength Steel Maraging T-250	Maraging T-250; Maraging MS 250; Maraging Free
1230	High Strength Steel H-13	Grade CH-13; GX40CrMoV5-1; X40CrMoV5; ESR I
1301	Stainless Steel Types 301 and 302	Type 301; SAE 30301; UNS 30100
1305	Stainless Steel Types 310, 310S	Type 310 (UNS S31000), 310S (UNS S31008), CK
1307	Stainless Steels Types 316 and 317	Type 316, 316L, 317, 317L; CF3M; CF8M
1308	Stainless Steel Type 321	Type 321, 321H (11); UNS J92630, S32100, S3210
1311	Stainless Steel 19-9DL	19-9 DL; AISI 651; UNS J92843, K63198, K63199;
1312	Stainless Steel Type 201	Type 201; AISI 201; UNS S20100; SAE 30201
1314	Stainless Steel 21-6-9	21-6-9; Nitronic 40; ASTM XM-11; UNS S21904; A
1330	Stainless Steel 15-15HS, SCF 260, Datalloy 2	Capenter 15-15HS, Carpenter SCF 260 Alloy, ATI

On-line Handbook

The Aerospace and High Performance Alloys Database includes an interactive on-line version of the printed handbook. The on-line PDF handbook supplements the AHAD by providing additional information about the metal alloys.

- General Overview
- Commercial Designations
- Alternative Designations
- Metal Specifications
- Composition
- Heat Treatment
- Forms & Conditions
- Melting & Casting
- Fabrication
- Metal Treatments

And many others...



AEROSPACE AND HIGH PERFORMANCE ALLOYS DATABASE

Ferrous • FeUH
H-13

August 2008

Author: J. C. Benedyk

Composition limits of H-13 based on the AISI/UNS (T20813) standards are (mass %): 0.32-0.45 C, 0.20-0.50 Mn, 0.80-1.20 Si, 4.75-5.50 Cr, 0.30 max Ni, 1.10-1.75 Mo, 0.80-1.20 V, 0.250 max Cu, 0.03 max P, and 0.03 max S. Where specified, as resulfurized H-13, sulfur may be increased to 0.06-0.15% to improve machinability.

Besides the standard H-13 grade, various modified, premium, and superior grades of H-13 are available from hot work steel producers, usually with limiting phosphorus and/or sulfur levels that are below the standard composition limits to improve toughness and thermal fatigue resistance and containing principle alloying elements in particular ranges that may be outside the T20813 standard. Also, the premium grades of H-13 within T20813 composition limits are generally produced by special refining and metallurgical practices to control microstructure and especially carbide size and distribution.

	Fe
5.0	Cr
1.5	Mo
1.0	V
0.35	C

1.0 General

This medium alloy, martensitic, air hardening, ultrahigh-strength steel is similar to H-11 and H-11 Mod in composition, heat treatment, and many properties. The steels H-11, H-11 Mod, and H-13 exhibit several properties that are important in airframe and landing gear applications, including the ability to be heat treated to an ultimate tensile strength of 300 ksi while having excellent thermal shock resistance. These grades are typically hardened by austenitizing and cooling in air, flowing inert gas, oil, or hot salt bath. Upon

H-13, which leads to a greater dispersion of vanadium carbides and higher wear resistance. The H-13 steel also has a slightly wider range of the other principal alloying elements, allowing producers flexibility in tailoring mechanical properties for given heat treatments and applications. Premium and superior grades of H-13 have carefully controlled compositions with low levels of sulfur and phosphorus and are produced by special melting, refining, and hot forging/rolling schedules primarily to achieve a fine microstructure and improve toughness and thermal fatigue resistance over conventionally produced H-13 grades. In a few cases, some H-13 producers employ long term, high temperature, homogenization techniques with controlled cooling to refine the carbide distribution and produce a more isotropic microstructure. Powder/particle metallurgy grades of H-13 are available with significantly refined distributions of carbides and sulfides (for the high sulfur, free machining grade) to improve toughness and thermal fatigue and wear resistance relative to conventional H-13 steel that is normally produced by ingot metallurgy. Careful consideration of H-13 supply will assure a cost effective selection of steel grade for a given application.

We Are Confident in Our Products

The AHAD is quick, efficient, and frequently updated, and is currently used by a growing list of universities, corporations and research facilities. Please visit www.cindasdata.com for a demo.

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