CINDAS Databases- What's in them for me?

A tutorial on using the CINDAS Interactive databases in your library

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Materials Properties

- Change with Temperature
  - Strength, ductility
  - Dimensions: expansion, contraction
- Some properties change with Time

- People who design structures (cars, airplanes, bridges, ships, turbines, oil infrastructures, etc.) need reliable materials data to pick the right material for the application.
  - Always want the best performance and lowest cost

CINDAS LLC Databases

- Aerospace and High Performance Alloys Database (AHAD)
- Aerospace Structural Metals Database (ASMD)
- Thermophysical Properties of Matter Database (TPMD)
- Microelectronics Packaging Materials Database (MPMD)

Who uses this the information?

- Current corporate and research customers include:
  - Aeronautical and Aerospace Industry
  - Government and Defense Industry
  - Oil and Gas Industry
  - Automotive and Transportation Industry
  - Power Generation Industry
  - Nuclear Research

Who uses this the information?

- Academic Departments and Research Groups
  - Chemical Engineering
  - Chemistry
  - Electrical and Electronics Engineering
  - Aerospace and Aeronautical Engineering
  - Materials Science
  - Mechanical Engineering
  - Nuclear Engineering
  - Physics and Applied Physics

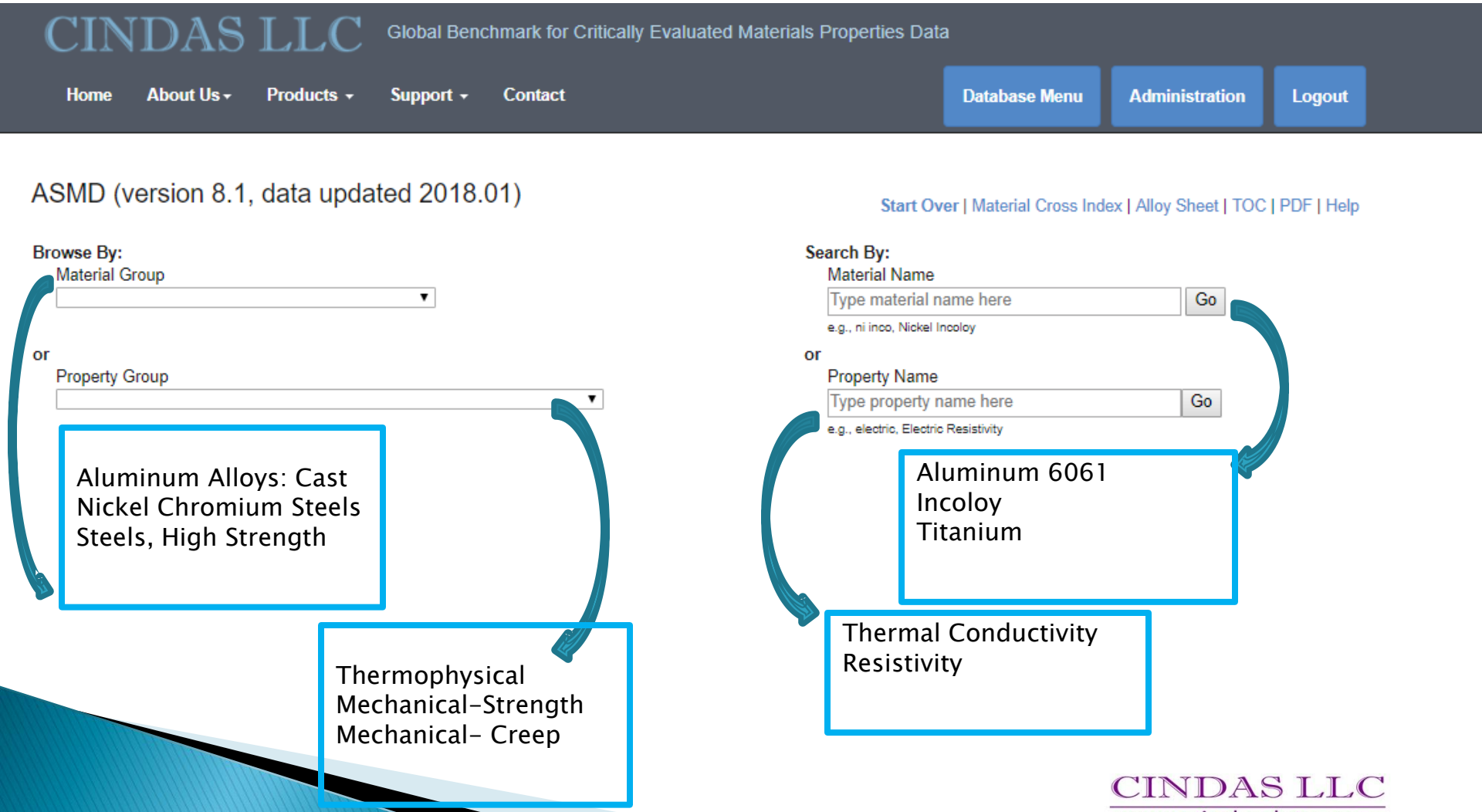
Some Common Examples of CINDAS Applications

- The following slides will take you through some examples of potential or existing uses including:
  - Aerospace and Defense including:
    - Modern Aircraft Design
    - Aluminum Aerospace Products
  - Aluminum Mold Plate
  - Armor
  - Automotive
  - Chemical Processing
  - Energy and Nuclear
  - Marine and Maritime
  - Medical
  - Oil and Gas

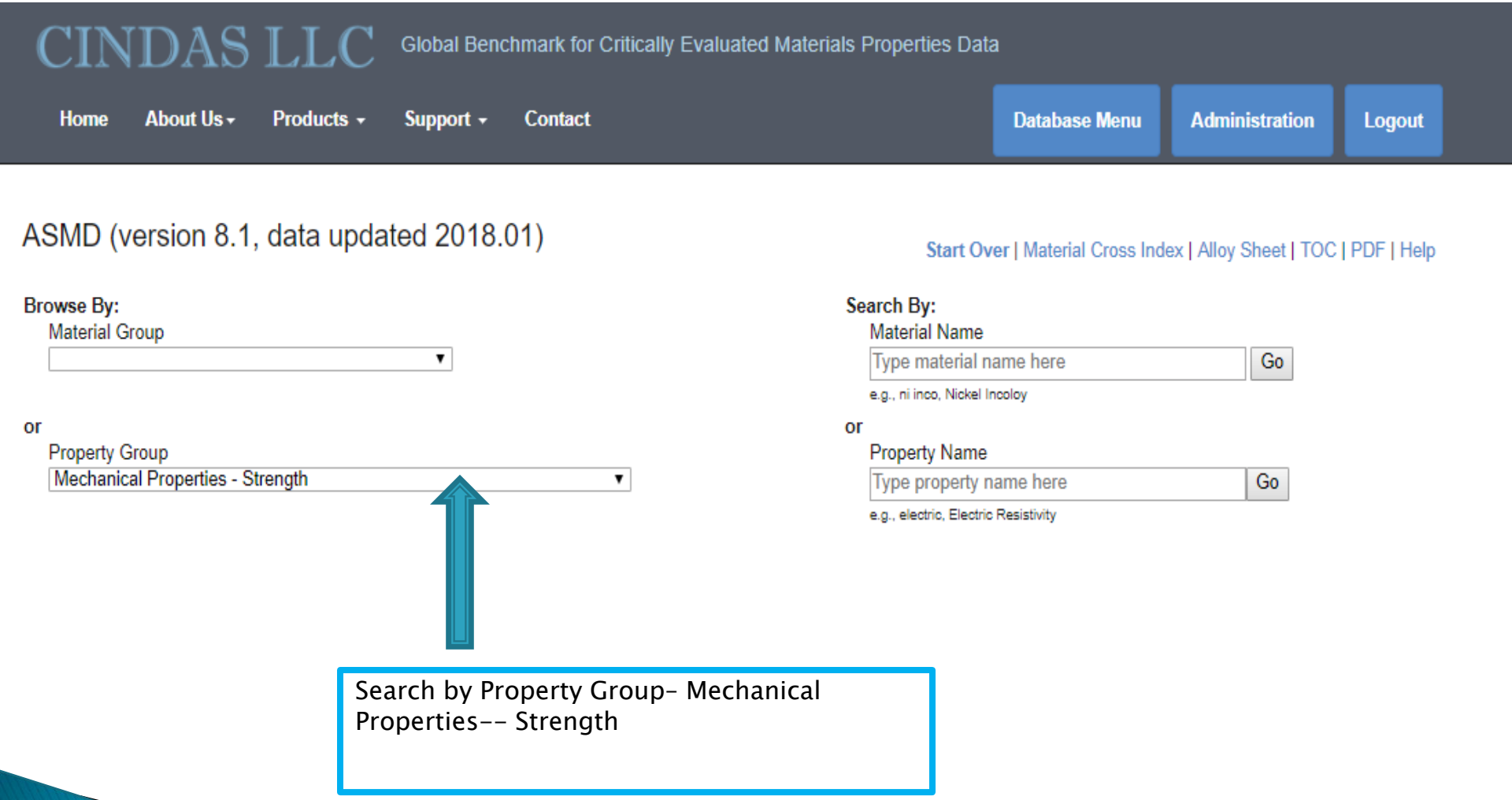
CINDAS Products Provide Important Data on Engineering Properties for Structural Materials

- **Corrosion**
  - How long a material will survive in a corrosion situation
- **Mechanical Strength**
  - Yield Strength – stress for permanent deformation
  - Tensile Strength – stress at Fracture
  - Strongly affected by temperature
- **Modulus** (stiffness)
  - How much a material will deform elastically under load
- **Ductility/Elongation**
  - How much a material will "stretch" before it breaks
- **Fracture Toughness**
  - In the presence of a crack, will the material survive the stress?
- **Fatigue**
  - During non-constant (cyclic) stresses, what is the lifetime of a material?

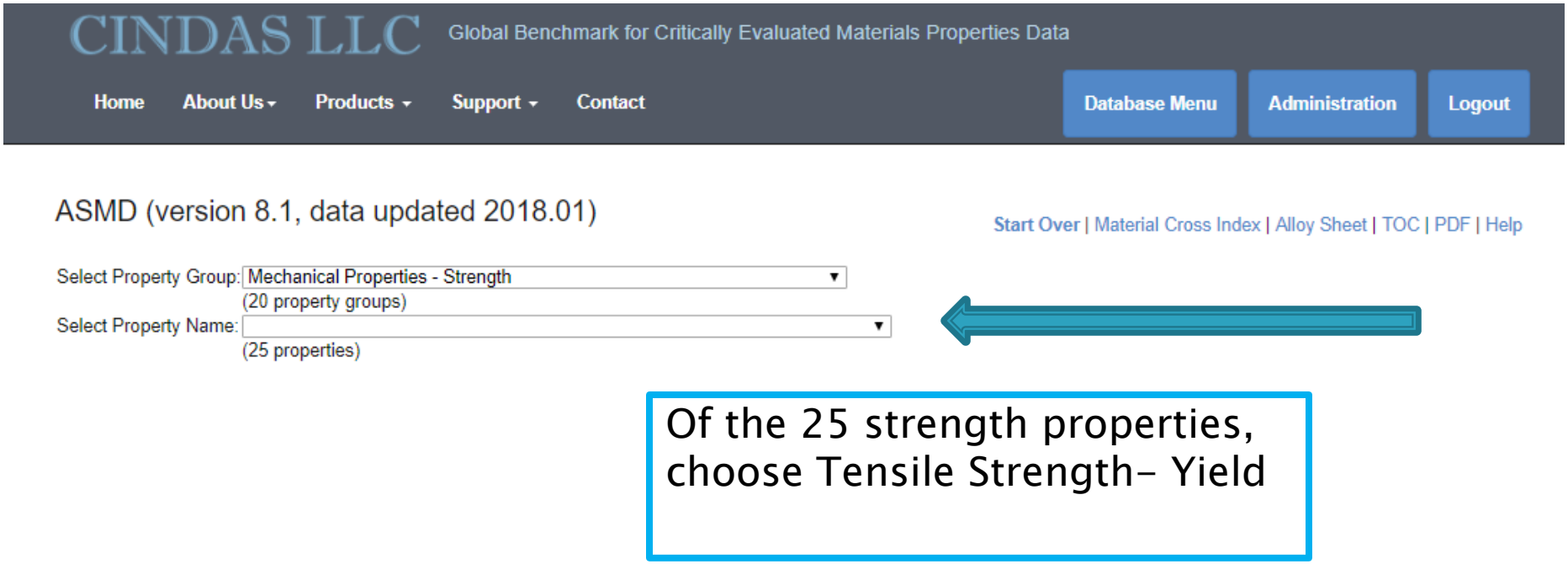
Four Ways to Search the Database



To compare same property of two or more materials search by property group.



Search by Property Group– Mechanical Properties-– Strength



Of the 25 strength properties, choose Tensile Strength- Yield

Choose Temperature as Independent Variable

225 materials have that property.

Specimen/Section Size (in)	0.01	30.0
Strain (fraction)	0.0	0.06
Strain Rate (min[-1])	1.98841697801e-08	4149.23
Strain Rate per sec (s[-1])	4e-07	972.8
Strain in % (percent)	0.44	7.31
Stress (ksi)	0.0	3.0
Stress Relief Time (h)	0.0	43.95
Stress-Relief Temperature (F)	75.0	1300.0
Stretch (percent)	0.00680665769043	16.0
Strontium Content (percent)	5.154639175e-05	0.02
Sulfur Content (percent)	0.00289489200795	0.02
Superplastic Strain (percent)	0.0	153.0
Temperature (F)	-462.0	5094.83
Temperature, Transformation (F)	450.0	1150.0
Tempering Temperature (F		
Tempering Time in min (m		
Tensile Strength, Ultimate		
Tensile Stress (ksi)		
Test Position/Specimen Lo		
Thermal Cycles(Rapid Heat		
Thickness (in)		
Thickness Location (altern		
Time Delay Before Quench		
Time Since Quench (h)		
Time to Indicated Creep/D		
Time^0.5 (h[1/2])		
Titanium Content (percent		
True Plastic Strain (fractio		
Upset Ratio (alternate/no		
Vickers (Diamond Pyramid)		
Wall Thickness (in)		
Webster B Hardness (B sca		
Width (in)		
Years Exposed (year)		
Yttrium Content, wt% (perc		
Zirconium Content (percen		

Show Graph | Show Text

Stress Relief Time (h)	0.0	39.45
Stretch (percent)	0.0013	16.0
Strontium Content (percent)	5.154639175e-05	0.02
Sulfur Content (percent)	0.00289591745177	0.02
Superplastic Strain (percent)	0.0	300.0
Temperature (F)	-453.0	3850.0
Temperature, Transformation (F)	575.0	625.0
Tempering Temperature (F)	67.5	1400.89
Tempering Time in min (min)	15.29	246.51
Tensile Strength, Ultimate (ksi)	138.53	279.2
Tensile Stress (ksi)	0.0	0.8
Test Condition (alternate/no units)	1.0	2.0
Test Position or Specimen Location (alternate/no units)	1.0	11.0
Thermal Cycles(Rapid Heat + WQ) (cycles)	0.0	9.53

ASMD (version 8.1, data updated 2018.01)

Property Group: Mechanical Properties - Strength
Property: Tensile Strength, Yield (ksi) Change Units ▾ Logarithmic
Independent Variable: Temperature (F) Change Units ▾ Logarithmic

Edit Select
Show Te

Select Materials ?

Select one or more materials from the list below. Hold the control key to select multiple materials. Available data curves will be displayed on the right. Then proceed to Step 2.

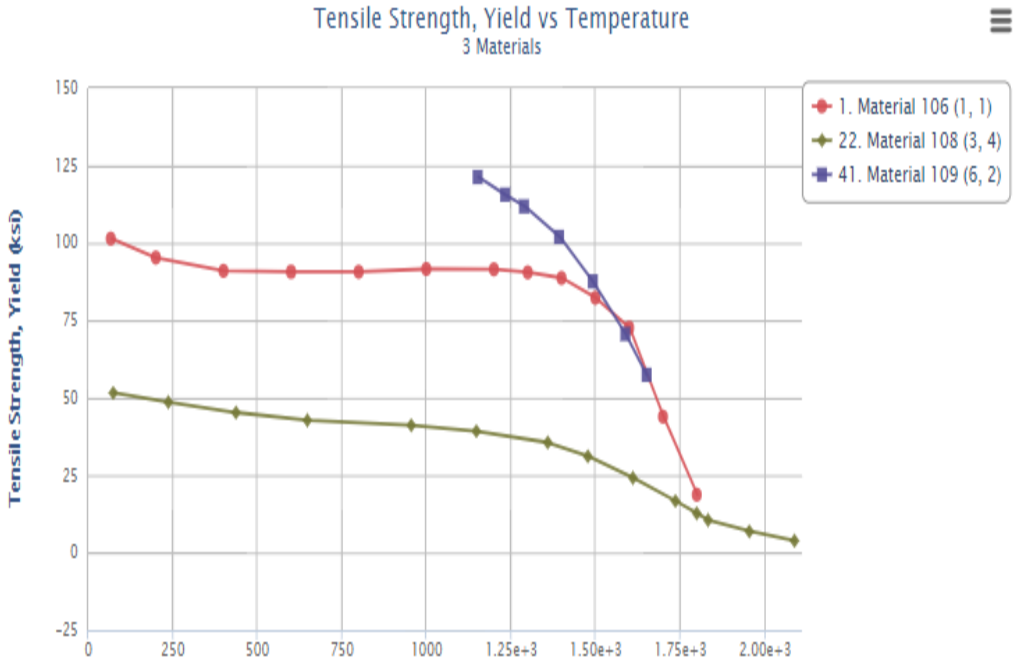
M102: Nickel Alloy HASTELLOY X, Ni-22Cr-18.5Fe-9Mo-1.5Co-.6W+.. UNS: N06002
M103: Nickel Alloy Haynes 230, Ni-22Cr-14W-2.5Co-2.0Mo-1.5Fe+.. Uns: N06230
M104: Nickel Alloy Haynes 242, Ni-25Mo-8Cr-2Fe-1Co+0.8Mn+..UNS: N10242
M105: Nickel Alloy Haynes 263, Ni-20Cr-20Co-5.85Mo-2.15Ti-0.7Fe+.. UNS: N06231/N07263
M106: Nickel Alloy Haynes 282, Ni-20Cr-10Co-8.5Mo-2.1Ti-1.5Fe+..

(Listing 229 materials)

Select Data Curves/Test Conditions ?

Select between one and twenty data curve descriptions from the list below to view graphs
Hold the Control key to select multiple data curves.
Key: Selected Material: (Set, Curve) - Remarks

1. M106 (1, 1) - C1: 0.2% offset, SA+age-hardened, sheet, exp data
2. M106 (2, 1) - C1: 0.2% offset, SA+age-hardened, plate, exp data
3. M106 (3, 1) - C1: 1/8" sheet autogenously welded with 1/8" dia wire, T, avg, as welded
4. M106 (3, 2) - C2: as welded/age-hardened
5. M106 (3, 3) - C3: as welded/solution annealed



Choose materials 106, 108, and 109.

Choose among sets of conditions for curves.

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Property Group: Mechanical Properties - Strength
Property: Tensile Strength, Yield (ksi) Change Units ▾ Logarithmic
Independent Variable: Temperature (F) Change Units ▾ Logarithmic

Can change units for both property and independent variable

Edit Select
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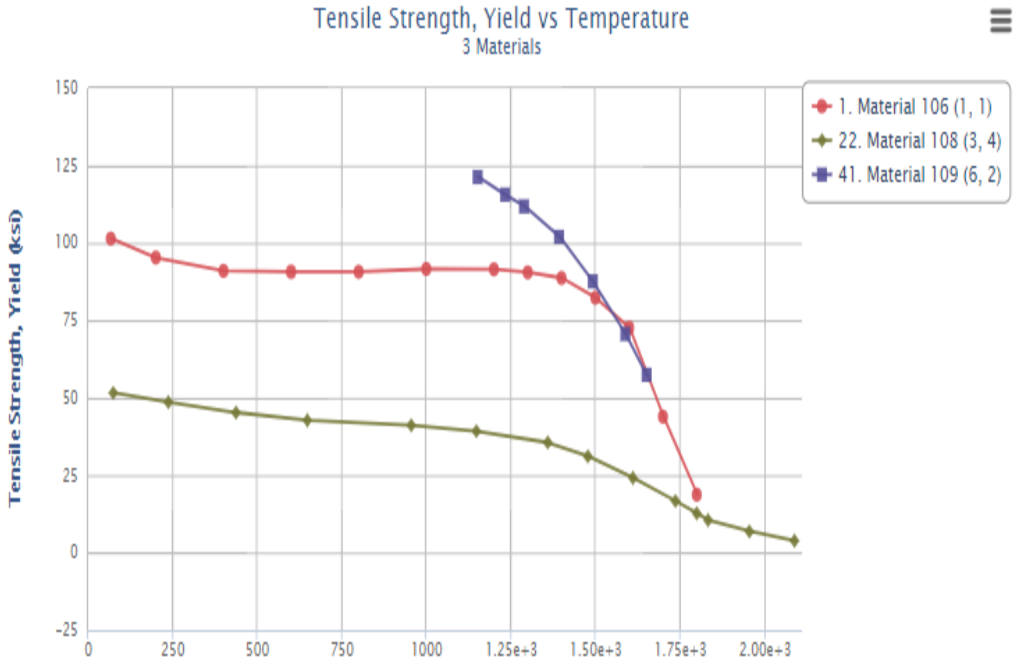

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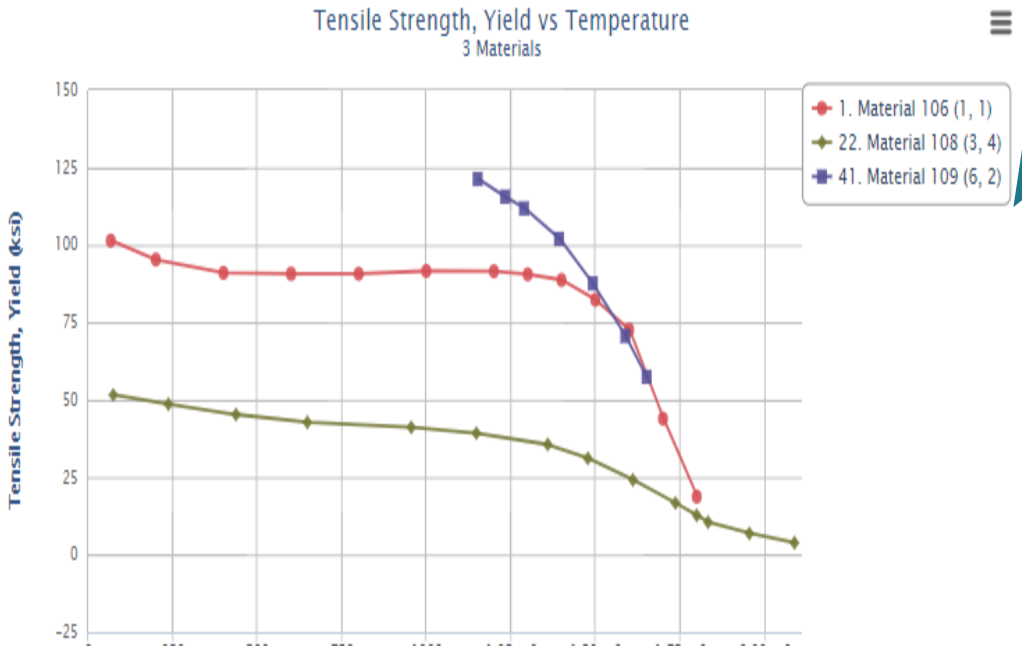
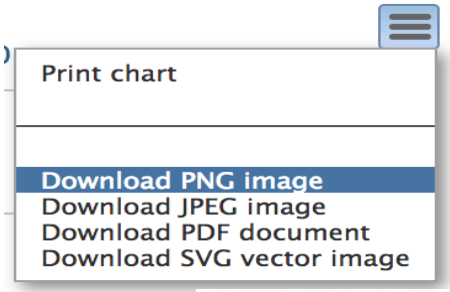


Choose to print or save in various formats



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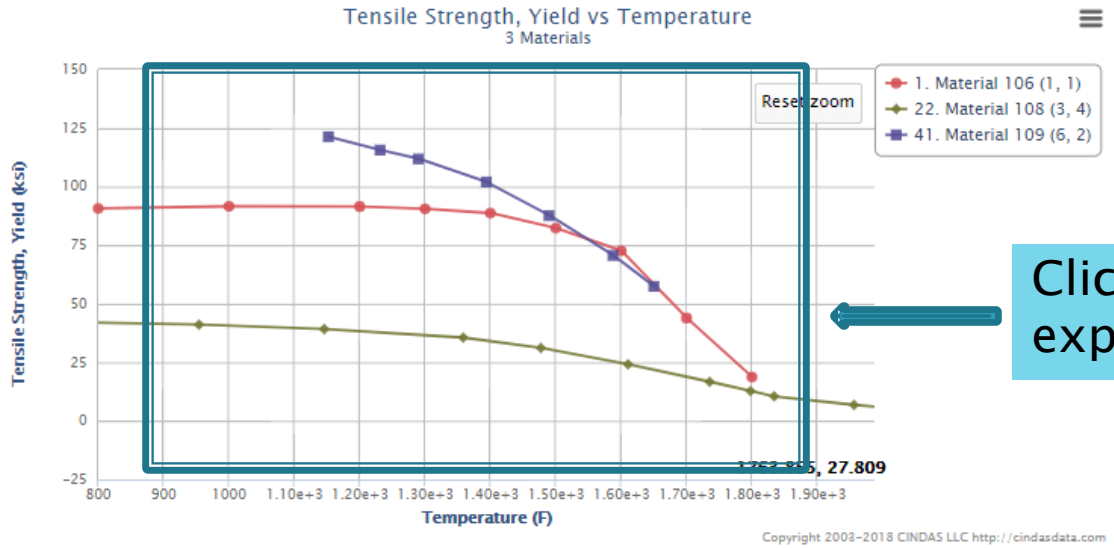

Click and drag cursor to expand graph.

Learn how to use advanced features in the Help section.

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Property Group: Mechanical Properties - Strength
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Edit Selection
Show Text

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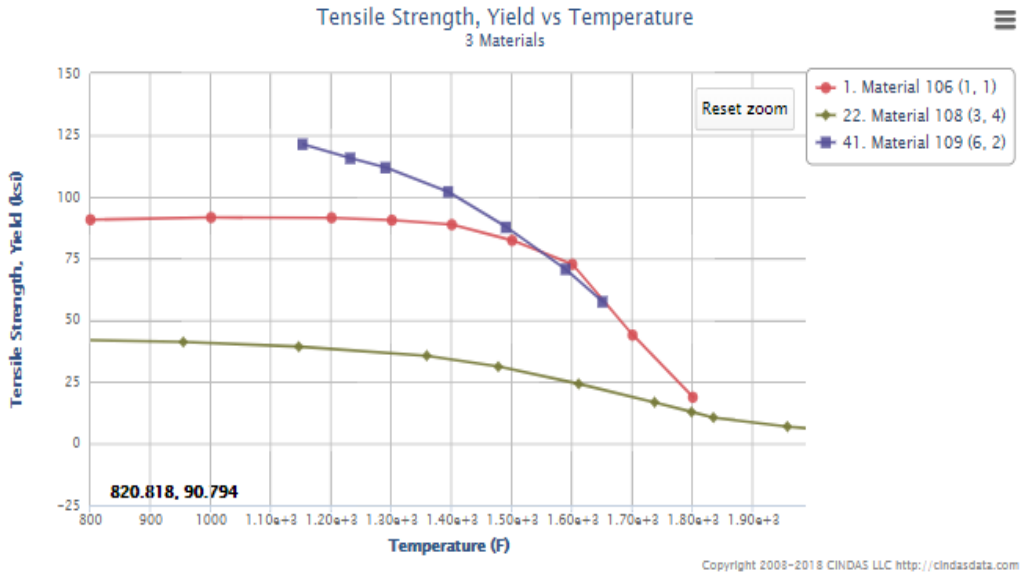

Click on SHOW TEXT link to get actual data points, test conditions and references.

Learn how to use advanced features in the Help section.

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ASMD (version 8.1, data updated 2018.01)

Property Group: Mechanical Properties - Strength
Property: Tensile Strength, Yield (ksi) Change Units ▾ Logarithmic
Independent Variable: Temperature (F) Change Units ▾ Logarithmic

Edit Selection
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M106: Nickel Alloy Haynes 282, Ni-20Cr-10Co-8.5Mo-2.1Ti-1.5Fe+..

(Listing 229 materials)

Select Data Curves/Test Conditions

Select a dataset from the box to show text

1. M106 (1, 1) - C1: 0.2% offset, SA+age-hardened, sheet, exp data
2. M106 (2, 1) - C1: 0.2% offset, SA+age-hardened, plate, exp data
3. M106 (3, 1) - C1: 1/8" sheet autogenously welded with 1/8" dia wire, T, avg, as welded
4. M106 (3, 2) - C2: as welded/age-hardened
5. M106 (3, 3) - C3: as welded/solution annealed

```
Material:            Nickel Alloy Haynes 282, Ni-20Cr-10Co-8.5Mo-2.1Ti-1.5Fe+..
Property:            Tensile Strength, Yield (ksi)
Independent Variable: Temperature (F)

Nickel Alloy Haynes 282, Ni-20Cr-10Co-8.5Mo-2.1Ti-1.5Fe+..

Tensile properties for sheet from room temperature to 1800 F.
(Fty, 0.2% offset, for this data set)

Specimen Form: Sheet.
Condition: Solution annealed at 2100F (1149C) +
    Age-Hardening: 1850F (1010C)/2h/AC + 1450F (788C)/8h/AC.
Test Condition: Temperature (X-var): at different levels, 70-1800 F.
Data were provided by author. Multiple heats and product sizes were used to determine
average values which were reported.

Data Points
    X            Y


Curve: 1
7.0000e+01    1.0140e+02
2.0000e+02    9.5300e+01
4.0000e+02    9.1000e+01
6.0000e+02    9.0700e+01
8.0000e+02    9.0700e+01
1.0000e+03    9.1600e+01
1.2000e+03    9.1500e+01
1.3000e+03    9.0500e+01
1.4000e+03    8.8700e+01
1.5000e+03    8.2300e+01
1.6000e+03    7.2600e+01
1.7000e+03    4.3900e+01
1.8000e+03    1.8700e+01
```

Conditions

Data

ASMD (version 8.1, data updated 2018.01)

Property Group: Mechanical Properties - Strength
Property: Tensile Strength, Yield (ksi) Change Units ▼ Logarithmic
Independent Variable: Temperature (F) Change Units ▼ Logarithmic

Edit Selection
Show Graph

Select Materials ?

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Then proceed to Step 2.

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M106: Nickel Alloy Haynes 282, Ni-20Cr-10Co-8.5Mo-2.1Ti-1.5Fe+..

(Listing 229 materials)

Select Data Curves/Test Conditions

25. M108 (4, 3) - C3: Smooth Curve
26. M108 (5, 1) - C1: Plate, Butt-Welded, Filler Metal Inconel 601, Exp Data
27. M108 (5, 2) - C2: Smooth Curve
28. M109 (1, 1) - C1: HT cond 1 (2120 F + 1920 F + 1580 F)
29. M109 (1, 2) - C2: HT cond 2 (2120 F to 1920 F to 1580 F)

```
Material:            Nickel Alloy IN 601, Ni-23Cr-1.5Al-14Fe UNS: N06601
Property:            Tensile Strength, Yield (ksi)
Independent Variable: Temperature (F)

Nickel Alloy IN 601, Ni-23Cr-1.5Al-14Fe

Effects of elevated temperatures on tensile property (Fty) of transverse
butt-weld joints made by gas tungsten arc process.

Specimen Form: Butt-welded 0.500" Plate.
Specimen Specification: Filler metal -  Inconel 601.
Specimen Condition: As-welded.
Tested from RT to ~2100F.

C1: Exp Data;
C2: Smooth Curve.

Data Points
      X           Y


Curve: 1
8.5958e+01    4.8436e+01    C1: Exp Data
1.0035e+03    3.8074e+01
1.4083e+03    3.4400e+01
1.7935e+03    1.2206e+01
2.0004e+03    7.1240e+00
2.0960e+03    4.2668e+00

Curve: 2
8.5958e+01    4.8436e+01    C2: Smooth Curve
2.4653e+02    4.5099e+01
4.9056e+02    4.1755e+01
8.3973e+02    3.9195e+01
1.1364e+03    3.7113e+01
1.3279e+03    3.5198e+01
1.4329e+03    3.3132e+01
1.5100e+03    2.9168e+01
1.5839e+03    2.3621e+01
1.6640e+03    1.7916e+01
1.7658e+03    1.3475e+01
```

Curves from same reference are shown together.

```
Material:             Nickel Alloy Haynes 263, Ni-20Cr-20Co-5.85Mo-2.15Ti-0.7Fe+..
Property:             Tensile Strength, Yield (ksi)
Independent Variable: Temperature (F)

Nickel Alloy Haynes 263, Ni-20Cr-20Co-5.85Mo-2.15Ti-0.7Fe+..

The alloy is solution heat treated at 2100F+/-25F  and rapidly cooled
or water quenched for optimum properties.
Following solution heat treatment, the alloy is aged-hardened at 1472F
(800C)/8 hours and air cooled. (Refs. 1, 2)

Tensile properties for sheet from room temperature to 2000F. (Fty,0.2% offset for this data set)

Specimen Form: Sheet.
Condition: 1. SA;
                      2. SA + 1472F/8h/AC.
Test Temperature (X-var): at different levels, RT-2000F.
Experimental data were reported for all curves.

C1: SA;
C2: SA + 1472F/8h/AC.


Data Points
       X                   Y


Curve: 1
7.5000e+01    4.9100e+01    C1: SA

Curve: 2

7.5000e+01    8.9200e+01    C2: SA + 1472F/8h/AC
4.0000e+02    8.2300e+01
8.0000e+02    8.0400e+01
1.0000e+03    7.6400e+01
1.2000e+03    7.5200e+01
1.4000e+03    7.6000e+01
1.5000e+03    6.8200e+01
1.6000e+03    4.3000e+01
1.7000e+03    1.7000e+01
1.8000e+03    1.2300e+01
2.0000e+03    5.5000e+00

References:

Ref No. 8  S. K. Srivastava, Unpublished Data., Haynes Interna-
tional, Inc., 2009.
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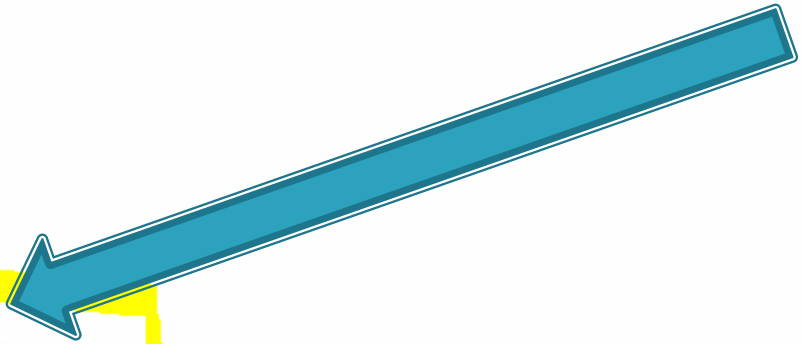
All data is referenced



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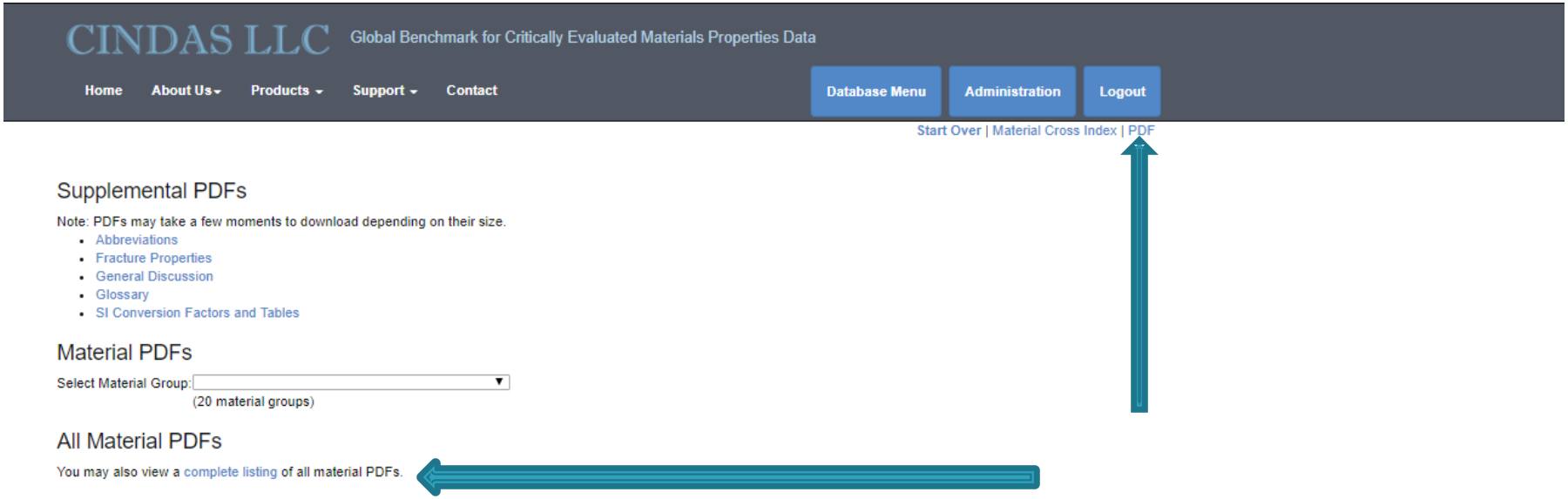

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Aluminum Alloy 2014, Clad 2014, Al-4.5Cu-1Mn-1Si-0.5Mg UNS: A92014
Aluminum Alloy 2024, Al-4.5Cu-1.5Mg-0.6Mn UNS: A92024
Aluminum Alloy 2048, Al-3.3Cu-1.5Mg-0.4Mn UNS: A92048
Aluminum Alloy 2090, Al-2.7Cu-2.3Li-0.12Zr UNS: A92090
Aluminum Alloy 2098, Al-3.5Cu-1.1Li-0.5Mg-0.4Ag-0.11Zr
Aluminum Alloy 2099, Al-2.7Cu-1.8Li-0.7Zn-0.3Mg-0.3Mn-.08Zr UNS A92099
Aluminum Alloy 2124, Al-4.4Cu-1.5Mg-0.6Mn UNS: A92124
Aluminum Alloy 2195, Al-4.0Cu-1.0Li-0.53Mg-0.43Ag+.. UNS: A92095
Aluminum Alloy 2219, Clad 2219, Al-6.3Cu-0.3Mn-0.18Zr-0.10V-0.06Ti UNS: A92219
Aluminum Alloy 2297, Al-2.8Cu-1.2Li-0.30Mn-0.12Zr
Aluminum Alloy 2519, Al-5.9Cu-0.3Mn-0.18Mg-0.18Zr-0.1V UNS: A92519
Aluminum Alloy 2618, Al-2.5Cu-1.5Mg-1.2Ni-1.0Fe+.. UNS: A92618
Aluminum Alloy 2624 & 2026, Al-4.05/3.95Cu-1.4/1.3Mg-0.58/0.55Mn+.. UNS:A92624/A92026
Aluminum Alloy 355/A355/C355, Al-5Si-1.3Cu-0.5Mg+.. UNS: A03550/A33550
Aluminum Alloy 356.0, A356.0, Al-7Si-0.3Mg UNS: A03560/A13560
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Aluminum Alloy 5059, Al-5.5Mg-0.9Mn-0.7Zn-0.15Cr UNS: A95059
Aluminum Alloy 5083, Al-4.4Mg-0.7Mn-0.15Cr UNS: A95083
Aluminum Alloy 5456, Al-5.1Mg-0.8Mn-0.10Cr UNS: A95456
Aluminum Alloy 6013, Al-0.9Mg-0.8Si-0.85Cu-0.50Mn UNS: A96013
Aluminum Alloy 6061, Al-1Mg-0.6Si-0.25Cu-0.20Cr UNS: A96061
Aluminum Alloy 6069, Al-1.4Mg-0.75Cu-0.9Si-0.2Cr+.. UNS: A96069
Aluminum Alloy 6082, Al-1Si-0.7Mn-1Mg UNS: A96082
Aluminum Alloy 7049, Al-7.6Zn-2.5Mg-1.5Cu-0.15Cr UNS: A97049
Aluminum Alloy 7050, Al-6.2Zn-2.25Mg-2.3Cu-0.12Zr UNS: A97050
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Aluminum Alloy 7085, Al-7.5Zn-1.65Cu-1.5Mg-0.12Zr+..
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Aluminum Alloy 7175, Al-5.6Zn-2.5Mg-1.6Cu-0.25Cr+.. UNS: A97175
Aluminum Alloy 7475, Al-5.6Zn-2.2Mg-1.5Cu-0.21Cr+.. UNS: A97475
Aluminum Alloy 8090, Al-2.5Li-1.3Cu-1.0Mg UNS: A98090
Aluminum Alloy 905XL, Al-4.0Mg-1.3Li-1.1C-0.5O
Aluminum Alloy A201.0, Al-4.5Cu-0.7Ag-0.3Mn-0.25Mg-0.25Ti UNS: A02010
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Aluminum Alloy X7005, Al-4.6Zn-1.4Mg-0.5Mn+.. UNS: A97005
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Beryllium, Be
Carbon Steel T-1, Fe-0.15C-0.8Mn-0.85Ni-0.53Cr-0.50Mo+..
Cobalt Alloy Haynes 188, Co-0.1C-22Cr-22Ni-14W-0.35Si-.03La UNS: R30188
Cobalt Alloy Inconel 783, Co-28Ni-25.5Fe-3Cr-.5Mn-.5Si-.03C+..UNS: R30783
Cobalt Alloy L-605 (Haynes 25), Co-20Cr-15W-10Ni-1.5Mn-0.1C+.. UNS: R30605
Cobalt Alloy Mar-M 509, Co-24Cr-10Ni-7W-3.5Ta+Ti+Zr

Select material

Alloys can be selected by AA Designation or composition.

Complete chapter for alloy- some as long as 100 + pages

1 General

Alloy 7055 is a wrought, heat-treatable alloy developed by Alcoa in the early 1990s through compositional modifications of aluminum alloy 7150. It is particularly designed to meet the needs for advanced compression-dominated airframe applications such as the upper wing structures of large commercial aircraft. These applications required improvements in specific strength, toughness and cyclic fatigue resistance coupled with greater resistance to both exfoliation corrosion and stress corrosion cracking compared to properties of previously available alloys. Alloy 7055-T77 plate and extrusions offer a strength increase of 10 percent relative to that of 7150-T6 and 30 percent relative to that of 7150-T76. The alloy also offers high fracture toughness and excellent resistance to growth of fatigue cracks. The attractive combination of properties of 7055-T77 is attributed to the high ratios of Zn/Mg and Cu/Mg and to modified heat treatments. In the T77 temper, the 7055 alloy provides a microstructure near grain boundaries that is resistant to both intergranular fracture and intergranular corrosion.

Alloy 7055 is suitable for aerospace applications such as compression-loaded, stiffened panels that also require good toughness, fatigue and corrosion resistance. Current or candidate applications include aircraft upper wing skins and stiffeners, skins for lower horizontal stabilizers and various other types of stiffeners. It is used in the Boeing 777 aircraft. Alloy 7055 has also been selected for an advanced lightweight, rapidly deployable military bridge structure concept. (Refs. 1–4, 10)

1.1 Commercial Designation

7055

1.2 Alternate Designations

UNS 97055

1.3 Specifications

AMS 4206, AMS 4324, AMS 4336, AMS 4337 (Refs. 5–8)

1.4 Composition

1.4.1 *[Table]* Composition

1.5 Heat Treatment

Temper T7751 (for plate) defines a solution heat-treated, stress-relieved and overaged condition. Solution heat treatment is accomplished by heating at 870 to 890F for a time commensurate with product thickness, followed by rapid cooling in a suitable quenching medium. The stress relief is as described above for T7751. The overaging treatment is not defined. (Ref. 8)

Temper T76511 (for extruded rod, bar and profiles) also defines a solution heat-treated, stress-relieved and overaged condition. The solution heat treatment is undefined; the stress relief treatment is as described above for T7751. Overaging heat treatment consists of heating at 240 to 250F for 4 to 6 hours followed by additional heating at 310 to 320F for 6.5 to 7.5 hours and air cooling. (Ref. 7)

Temper T77 has also been described as consisting of aging for 40 hours at 250F plus 0.5 hour at 360F plus another 24 hours at 250F. These aging treatments were conducted on cast, homogenized and hot-rolled strip which had been solution annealed for 1 hour at 890F. (Ref. 9)

Peak hardness is achieved in wrought strip after annealing at 30–40 hours at 250F, as shown in Fig. 1.6.1.

Additional details on heat treatment conditions are proprietary to the manufacturer.

	Al
8.0	Zn
2.3	Cu
2.0	Mg
0.16	Zr

1.6 Hardness

1.6.1 *[Figure]* Effects of aging time and silver content on hardness of wrought and annealed strip

1.7 Forms and Conditions Available

Alloy 7055 is available in rolled plate and extruded forms. A sheet product is under development as of this writing.

Plate is normally supplied in the T7751 condition. Extrusions are most commonly supplied in the T77511 condition but are also available in T76511 and T74511 conditions. Extrusions are also avail-

All chapters are organized in the same manner, with same sections i.e. Composition Section will always be 1.3

3.3.1.3 *[Figure]* Effect of strain rate on typical tensile true stess-true strain curves for fine-grained extrusion exhibiting superplastic behavior at test temperature of 797F

3.3.1.4 *[Figure]* Effect of test temperature on typical tensile true stress-true strain curves for fine-grained extrusion exhibiting superplastic behavior at a strain rate of 1.4 x 10^{-3} s^{-1}

3.3.1.5 *[Figure]* Effect of strain rate on elongation to failure for fine-grained extrusion exhibiting superplastic behavior at test temperatures of 572 and 797F

3.3.1.6 *[Figure]* Effects of test temperature and grain size on elongation to failure for fine-grained alloy exhibiting superplastic behavior at strain rate of 1.4 x 10^{-3} s^{-1}

3.3.2 Compression Stress-strain Diagrams and Compression Properties

3.3.3 Impact

3.3.4 Bending

3.3.5 Torsion and Shear

3.3.6 Bearing

3.3.7 Stress Concentration

3.3.7.1 Notch Properties

3.3.7.2 Fracture Toughness

3.3.8 Combined Loading

3.4 Creep and Creep Rupture Properties

3.5 Fatigue Properties

3.5.1 Conventional High-cycle Fatigue
The fatigue strength of 7055-T7751 plate is decreased by increasing the test temperature from 80 to 375F for both longitudinal (L) and long transverse (LT) orientations (Fig. 3.5.1.5). (Ref. 4)

3.5.1.1 *[Figure]* Effects of thickness and orientation on smooth axial high-cycle fatigue behavior of T7751 plate at room temperature in high humidity air environment

3.5.1.2 *[Figure]* Effects of thickness and orientation on notched axial high-cycle fatigue behavior of T7751 plate at room temperature in high humidity air environment

3.5.1.3 *[Figure]* Effects of temper and thickness on smooth axial high-cycle fatigue behavior of T74511 and T76511 extrusion at room temperature in high humidity air environment

3.5.1.4 *[Figure]* Effects of temper and thickness

3.5.1.5 *[Figure]* Effects of orientation and test temperature on smooth axial high-cycle fatigue behavior of T7751 plate

3.5.2 Low-cycle Fatigue

3.5.3 Fatigue Crack Propagation

3.5.3.1 *[Figure]* Effects of thickness on fatigue crack growth behavior of T7751 plate at room temperature at ratio of minimum stress of +0.1 in high humidity air environment

3.5.3.2 *[Figure]* Fatigue crack growth behavior of T7751 plate at room temperature at ratio of minimum stress to maximum stress of +0.33 in high humidity air environment

3.6 Elastic Properties

3.6.1 Poisson's Ratio, 0.32–0.33 (Ref. 1)

3.6.2 Modulus of Elasticity, 10.3 to 10.4x10^3 ksi in tension, 10.7 to 11.0x10^3 ksi in compression (Ref. 1)

3.6.3 Modulus of Rigidity, 3.9x10^3 ksi (Ref. 1)

3.6.4 Tangent Modulus

3.6.4.1 *[Figure]* Effect of orientation on typical compression tangent modulus curves for T7751 plate at room temperature

3.6.4.2 *[Figure]* Effect of orientation on typical compression tangent modulus curves for T7451 extrusion at room temperature

3.6.4.3 *[Figure]* Typical compression tangent modulus curves for T76511 extrusion at room temperature

3.6.4.4 *[Figure]* Effect of orientation on typical compression tangent modulus curves for T77511 extrusion at room temperature

3.6.5 Secant Modulus

4 Fabrication

4.1 Forming

4.1.1 General

4.1.2 Billet Conversion

4.1.3 Secondary Processing

4.2 Machining and Grinding

Machining, drilling and sawing of 7055 products can be accomplished using setups, speeds and feeds normaly utilized during shop operations on high strength, artifically aged aluminum 7xxx

Clicking on reference will take user to list at end of chapter

Complete list of references for data in chapter

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Some data cannot be inserted into graphs. That data is found in the PDF files

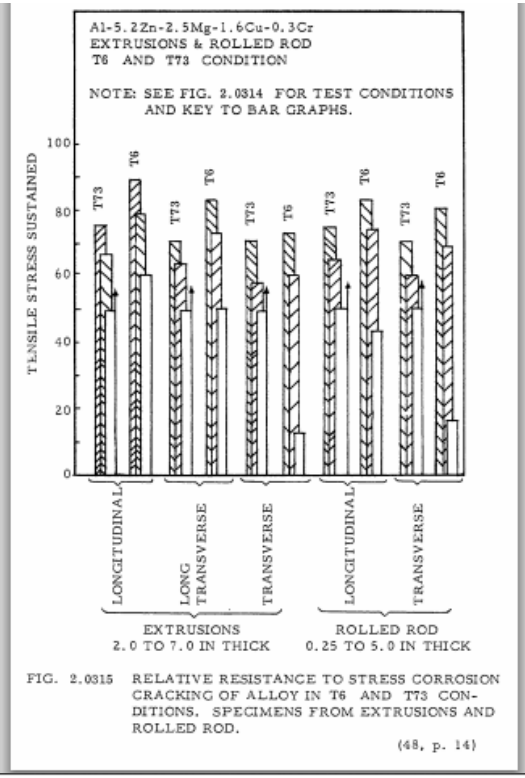

FIG. 2.0315 RELATIVE RESISTANCE TO STRESS CORROSION CRACKING OF ALLOY IN T6 AND T73 CONDITIONS. SPECIMENS FROM EXTRUSIONS AND ROLLED ROD.

(48, p. 14)

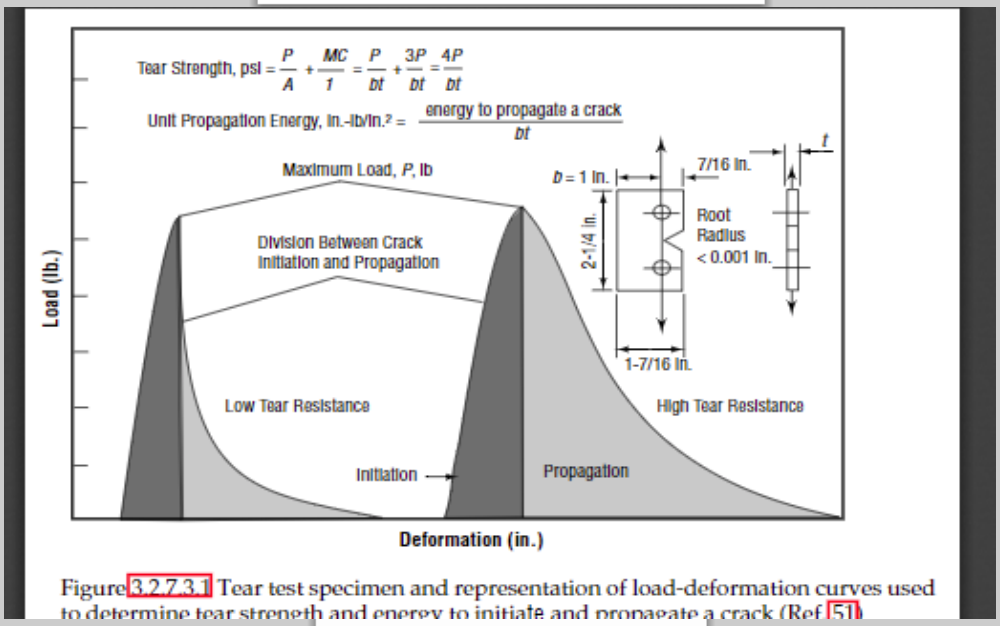

Figure 3.2.7.3.1 Tear test specimen and representation of load-deformation curves used to determine tear strength and energy to initiate and propagate a crack (Ref 51)

Microstructures and Other Photographs can be Found in the PDF Chapters for Each Alloy

Annealed condition, sheet

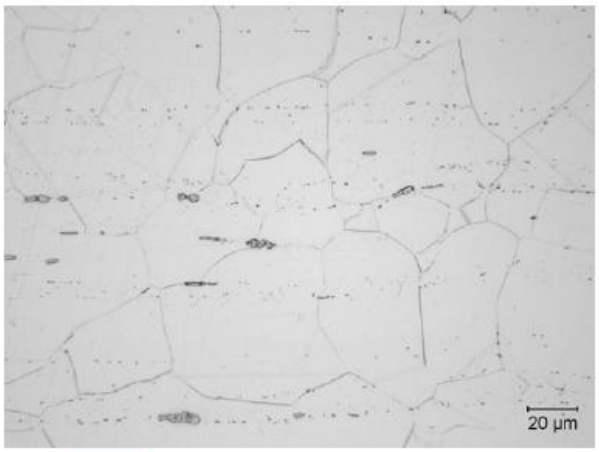

Figure 2.1.2.2 Microstructure of HAYNES 263 sheet in the annealed condition

Aged condition, plate

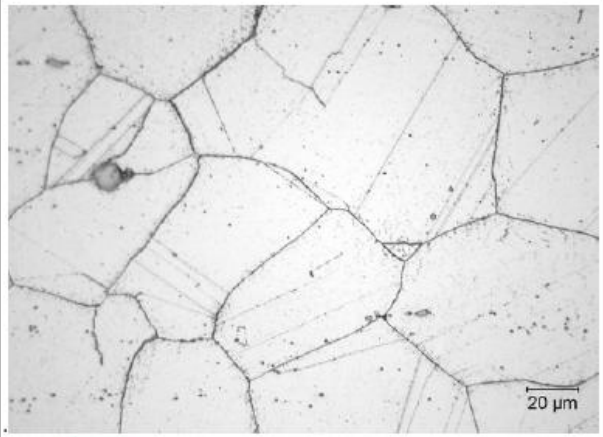

Figure 2.1.2.3 Microstructure of HAYNES 263 thin plate in the aged condition

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