Super High Strength Al Alloy 7042

Super Strong & Tough | Cast & Wrought Aluminum Alloy

» Initially designed to replace Ti-5Al-2.5Sn ELI alloy for Liquid H2 Turbopump Impellers

» The 7042-T6 alloy has excellent strength and toughness in the temperature range from -450°F (-267°C) to 220°F (100°C)

» Direct Chill cast 7042-T6 has mechanical properties similar to 7075-T6 or 7050-T74 forgings, but with superior stress-corrosion resistance as compared to these alloys

» Forged products made from 7042-T6 are 25-35% stronger and tougher than similar forgings made of 7075-T6 and 7050-T74 alloys

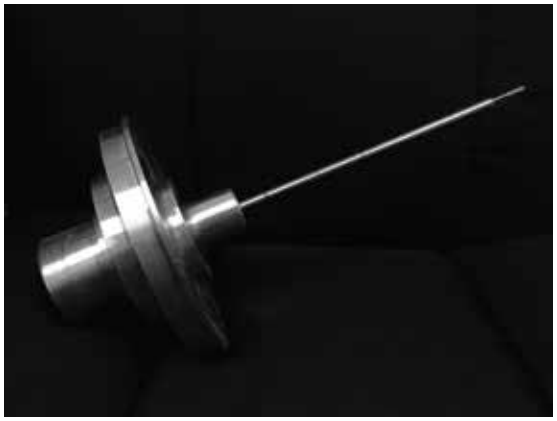
» Extruded 7042-T6 products have a ~30% higher specific strength than Ti alloys

» 7042 has good liquid fluidity and hot tear resistance for sand casting of high-strength components with wall thicknesses of up to 2 inches.

Intellectual Property

UES has protected AA 7042 technology through US Patents: 7,048,815 and 7,060,139.

Image to the Right: Liquid Hydrogen Turbo pump Impeller tested by P&W Rocketdyne.



7042-T6: Typical Tensile Properties of DC Cast Products

Extrusion Ratio	Diameter Inches	Temperature (˚F / ˚C)	Tensile			Fatigue	Toughness	Hardness
			Ultimate (ksi / MPa)	Yield (ksi / MPa)	Elongation (%)	Fatigue Limit[1] (ksi / MPa)	K_{1c}, (ksi$\sqrt{in}$ / MPa$\sqrt{m}$)	Rockwell C
16:1	0.75	-321 / -196	132.3 / 912.2	128.2 / 883.9	9		37.3 / 41.0	
		73 / 22.8	104.2 / 718.4	96.4 / 664.7	15	42.8 / 295.1	43.6 / 47.9	20
6:1	3.0	-321 / -196	128.1 / 883.2	121.4 / 837.0	9			
		73 / 22.8	101.6 / 700.5	93.5 / 644.7	15			15
11:1	6.0	-321 / -196	120.0 / 827.4	108.1 / 745.3	13			
		73 / 22.8	97.2 / 670.2	88.6 / 610.9	14			15
19:1	Tubing 0.752 ID	-321 / -196	126.2 / 870.1	118.0 / 813.6	9			
		73 / 22.8	101.2 / 697.7	94.5 / 651.6	12	Burst Pressure = 27,000 psig		

[1] In 10^7 cycles, R=0.1 axially loaded specimens

Chemical Composition Limits

Weight %	Main Elements									Others	
	Si	Fe	Cu	Mn	Mg	Zn	Cr	Sc	Zr	Each	Total
Minimum	0.01	0.01	1.3	0.20	2.0	6.5	0	0.18	0.11	-	-
Maximum	0.20	0.20	1.9	0.40	2.8	7.9	0.05	0.50	0.20	0.05	0.15

7042-T6: Typical Mechanical Properties of Forged Product (15 to 27 lb)

Temperature (˚F / ˚C)	Tensile			Fatigue	Toughness	Hardness
	Ultimate (ksi / MPa)	Yield (ksi / MPa)	Elongation (%)	Fatigue Limit[1] (ksi / MPa)	K_{1c}, (ksi$\sqrt{in}$ / MPa$\sqrt{m}$)	Rockwell C
-452 / -269	116.7 / 804.6	103.6 / 714.3	6	-	21.7 / 23.8	-
-321 / -196	102.9 / 709.5	91.3 / 629.5	6	50.7 / 349.6	21.7 / 23.8	-
73 / 23	87.2 / 601.2	76.1 / 524.7	13	46.4 / 319.9	31.7 / 34.8	94

[1] In 10^7 cycles, R=0.1 axially loaded specimens

7042-T6: Typical Tensile Properties of Small Forgings (up to 4.5 lbs)

Temperature (˚F / ˚C)	Ultimate (ksi / MPa)	Yield (ksi / MPa)	Elongation %
-321 / -196	113.0 / 779.1	100.0 / 689.5	8
73 / 22.8	90.9 / 626.7	81.9 / 546.7	12

For More Information

Please contact us at info@ues.com,
Ph: 937.426.6900, Fax: (US) 937.429.5413
UES, Inc., 4401 Dayton-Xenia Rd.,
Dayton, Ohio 45432-1894;
www.ues.com

7042-T6: Physical and Elastic Properties

Characteristics	Temperature (˚F / ˚C)	Value (English Units)	Value (Si Units)
Normal Density	73 / 23	176.0 lb ft $^{-3}$	2.82 g cm $^{-3}$
Melting Range	950 - 1175 / 510 - 635	968 - 1175 ˚F	793 K - 908 K
Coefficient of Thermal Expansion	-369 / -223	5.56 x 10^{-3} ˚F $^{-1}$	10 x 10^{-3} K $^{-1}$
	-234 / -148	8.33 x 10^{-3} ˚F $^{-1}$	15 x 10^{-3} K $^{-1}$
	-117 / -83	11.1 x 10^{-3} ˚F $^{-1}$	20 x 10^{-3} K $^{-1}$
	45-85/ 7 - 29	13.0 x 10^{-3} ˚F $^{-1}$	23.4 x 10^{-3} K $^{-1}$
Thermal Conductivity	-274 / -170	39.3 BTUhr^{-1} ft^{-1} ˚F $^{-1}$	68 W m^{-1} K $^{-1}$
	-96 / -71	58.9 BTUhr^{-1} ft^{-1} ˚F $^{-1}$	102 W m^{-1} K $^{-1}$
	82 / 28	76.3 BTUhr^{-1} ft^{-1} ˚F $^{-1}$	132 W m^{-1} K $^{-1}$
Young's Modulus	-452 / -269	12,082 ksi	83.3 GPa
	-321 / -196	11,864 ksi	81.8 GPa
	-119 / -84	11,327 ksi	78.1 GPa
	73 / 23	10,747 ksi	74.1 GPa
Shear Modulus	-452 / -269	4,482 ksi	30.9 GPa
	-321 / -196	4,409 ksi	30.4 GPa
	-119 / -84	4,235 ksi	29.2 GPa
	73 / 23	4,032 ksi	27.8 GPa
Poisson's Ratio	-452 / -269	0.347	0.347
	-321 / -196	0.346	0.346
	-119 / -84	0.337	0.337
	73 / 23	0.331	0.337