Sports equipment: Since Beralcast® alloys can be altered for specific properties; the performance of sports equipment can be tailored to meet specific designs and markets. Reduced weight with an increase in stiffness and improved vibration damping characteristics add value to high-end sports equipment such as bicycle rims and golf club components. Typical Beralcast® alloys have about half the weight of titanium, and twice its stiffness, while rivaling its performance.

Comparison of Beralcast® to Commonly Used Materials

Property Description	Units	Beralcast® 363	Beralcast® 191	A356-T6 Al	Ti-6Al-4V (Cast)	AZ91Mg	Beralcast® 310	AlBeMet HIP'd AM162H	Be S200F	6061 T6 Al
Density	g/cm3 @ 250C lbs/in3 @ 770F	2.16 0.078	2.16 0.078	2.69 0.097	4.43 0.160	1.81 0.066	2.16 0.078	2.10 0.076	1.85 0.067	2.70 0.098
Melting Point (Liquidus)	0C 0F	645 1193	645 1193	615 1135	1660 3020	595 1005	645 1193	1082 1980	1185 2345	652 1206
Coefficient of Thermal Expansion	µm/m (ppm) @ 25oC µin/in (ppm) @ 77oF	14.2 7.9	13.4 7.4	21.5 11.9	9.0 5.0	26.0 14.0	Longitu-dinal 13.2 7.6	13.9 7.7	11.4 6.3	23.6 13.2
Specific Heat	J/kg-oK @ 20oC Btu/lb-oF @68oF	1250.0 0.30	1423.5 0.34	963.0 0.23	597.0 0.14	1046.7 0.25	Similar To 191	1506.0 0.36	1925.0 0.46	896.0 0.21
Thermal Con-ductivity	W/m-oK @ 25oC Btu/h-ft-oF @ 77oF	105.5 61.0	180.0 104.0	152.3 88.0	7.8 4.5	72.7 42.0	Longitu-dinal Similar to 191	210.0 121.0	216.3 125.0	167.0 96.5
Modulus of Elasticity in tension	Gpa @ 25oC mpsi @ 77oF	202.0 29.3	202.0 29.3	72.4 10.5	110.0 16.0	44.8 6.5	202.0 29.3	192.0 28.0	303.4 44.0	68.3 10.0
Specific Stiff-ness (Modu-lus/Density)	Gpa-cm3/g @ 25oC Mpsi-in3/lbs @ 77oF	93.5 375.6	93.5 375.6	26.9 108.2	24.8 100.0	24.8 98.5	93.5 375.6	-- --	164.0 656.7	25.3 102.0
Poissons Ratio		0.20	0.20	0.33	0.33	0.35	--	0.14	0.18	0.33
Yield Strength	mpa @ 25oC Ksi @ 77oF	213.7 31.0	137.9 20.0	206.8 30.0	890.0 129.0	151.7 22.0	325.4 47.2	192.0 28.0	241.3 35.0	275.8 40.0
Ultimate Ten-sile Strength	mpa @ 25oC Ksi @ 77oF	289.6 42.0	196.5 28.5	275.8 40.0	1035.0 150.0	227.5 33.0	426.1 61.8	-- --	-- --	310.3 45.0
Specific Strength (UTS/ Density)	Mpa-cm3/g @ 25oC Ksi-in2/lbs @ 77oF	134.1 538.5	91.0 365.4	102.5 412.4	233.6 937.5	125.7 500.0	197.3 792.3	-- --	-- --	114.9 459.2
Elongation 2.54 cm (1in) Gage	% @ 25oC % @ 77oF	3.0 3.0	1.7 1.7	3.0 3.0	10.0 10.0	3.0 3.0	13.2 13.2	-- --	-- --	17.0 17.0
Axial Fatigue (R=-1.0) 10^7 Cycles	mpa @ 25oC Ksi @ 77oF	117.2 17.	-- --	144.8 21.0	-- --	137.9 20.0	220.6 32.0	-- --	-- --	96.5 14.0

NOTE: All properties listed are typical (or average), ambient temperature (68oF to 77oF (20oC to 25oC)) values unless specified otherwise

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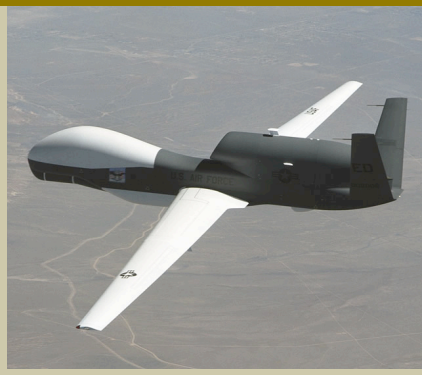
IBC Advanced Alloys Corp.

Beralcast® - Castable Beryllium-Aluminum Alloys



Beralcast® Corporation, a wholly owned subsidiary of IBC Advanced Alloys Corp, has a family of beryllium-aluminum alloys that overcomes the limitations of pure beryllium and existing beryllium-aluminum alloys, while retaining the benefits of the two metals.

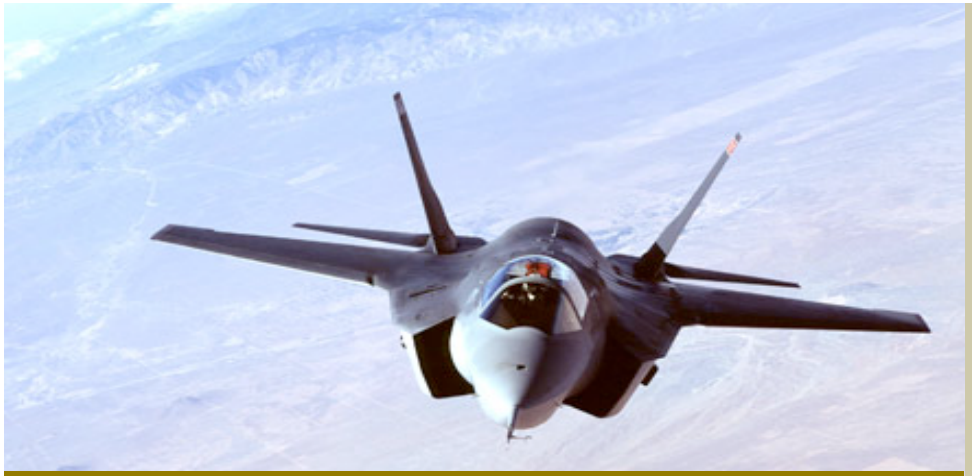
The patented alloys, called **Beralcast®**, combine beryllium's light weight and high stiffness with aluminum's excellent processing characteristics and low cost. Beralcast® alloys contain minor elemental additions to beryllium and aluminum to form alloys that can be cast using a process similar to conventional investment casting. Earlier alloys, which were available only in powder form, had to be processed using rolling, extrusion, and powder metallurgy technologies that limited their geometrical shapes and increased costs. Beralcast® alloys can be cast into complex shapes that need little or no machining.

Technology:

One of the most commonly used materials for lightweight, high-stiffness flight, space, electronics, and industrial hardware applications has been pure powder metallurgy beryllium. Pure beryllium has a unique combination of low density and desirable mechanical, thermal, and optical properties not found in any other material.

However, in its pure form, beryllium is too brittle for many applications. It is also very expensive and difficult or impossible to fabricate into highly-complex and precise volume-constrained configurations. This has limited its use to historical designs and machining fabrication techniques, such as powder metallurgy. Because of these constraints, pure beryllium is not an ideal candidate for mass production; commercial industries have, up until now, avoided using beryllium in their products, resorting to less exotic and expensive materials such as aluminum.

Berlacast's® casting process allows very complex near-net and net shapes to be fabricated with little or no machining. In general, any part that can be investment cast in aluminum can also be investment cast in Beralcast®. The process overcomes the primary limitations of existing beryllium aluminum and pure beryllium powder metallurgy technology while retaining the benefits of the beryllium-aluminum material.



Primary Members of the Beralcast Family:

Beryllium Aluminum Alloys

Several years ago, researchers and engineers came up with an idea to combine beryllium with a second material as a way to economically circumvent the shortcomings of pure beryllium. One ideal second material was aluminum. Utilizing the best attributes of each material and eliminating many individual shortcomings, beryllium-aluminum alloys are a very attractive, low cost alternative for lightweight, high-stiffness applications. They combine the high modulus of elasticity and low density characteristics of beryllium with the excellent processing characteristics and lower cost of aluminum.

- **Beralcast® 363: general, high-strength composition used primarily for precision cast structural applications**
- **Beralcast® 191: moderate-strength composition used primarily for cast electronic and thermal packaging applications**
- **Beralcast® 310: composition for cast and wrought products, used primarily for select directional high-strength and thermal control applications.**

Beralcast® alloys have numerous advantages over other competing materials and particularly over each of its primary component materials (aluminum and beryllium). Utilizing the synergistic effects of an alloyed metal matrix of the two primary components, Beralcast® materials offer a unique combination of improvements.

Beralcast® Advantages over Aluminum:

- **Approximately 22 percent lower density with essentially equivalent yield strength to cast A356 aluminum**
- **Approximately 3 times stiffer (modulus of elasticity in tension)**
- **Approximately 2 to 4 times more dimensional stable than aluminum**
- **Approximately 30 percent lower in coefficient of thermal expansion (CTE) for matching of mating parts.**

Beralcast® Advantages over Beryllium:

- **Approximately 3 times greater ductility than hot pressed beryllium**
- **Castable, for complex and precise net shape configurations**
- **Weldable for defect repair**
- **Reduced scrap generation, machining and environmental process concerns. Does not require post-machined chemical milling**
- **About 1/4 the raw material input cost**

In addition to its straight density advantages, Beralcast's® unique combination of properties has resulted in up to a 50-percent savings in weight over aluminum, based on stiffness driven design, by reducing the casting section thickness required.

Additional Applications:

Beralcast® alloys can be used in virtually any commercial and military application requiring complex, lightweight, and/or high-stiffness parts. In general, it serves as a higher performance and/or lower cost replacement material for cast aluminum, magnesium, titanium, metal matrix composites, nonmetallic composites, and pure beryllium or powder metallurgy beryllium-aluminum. Some of these applications include the following:

Disk drive armatures: Disk drive armatures made of Beralcast® materials allow disk drives to retrieve more electronic data at a faster rate than existing technology (aluminum). This enhanced performance is due to the material's light weight, good heat transfer capabilities, and high stiffness resulting in superior damping qualities. The better damping capabilities reduce the delay time in unit stabilization allowing information to be accessed much faster.

Aerospace and Defense systems: Because it is lightweight with a high modulus of elasticity and can be precision cast for isotropic property stability, Beralcast® alloys are especially attractive for advanced electro-optic and electronic components, such as sensor and guidance equipment in flight and satellite systems.

Manufacturing

Berlacast® Corporation is currently producing parts in a low to moderate-rate investment casting facility with plans to relocate to a new facility in the near future. Currently, Beralcast® can be precision cast, depending on the part configuration, to wall thicknesses of less than 2 mm and more than 15 mm and to sizes up to 0.75 meter in any direction and greater for select orientations.