

A close-up photograph of a CNC machine's tool bit working on a complex metal part, likely a cylinder head, with various holes and ports. The background is a soft, blue-tinted industrial setting.

# Alcoa Specialty Alloys: **351 SupraCast™**

## **Superior alloy for high performance powertrain applications**

Over a decade of research with Alcoa's Technical Center culminated in an alloy solution suitable for components exposed to the elevated temperatures in high performance engines.

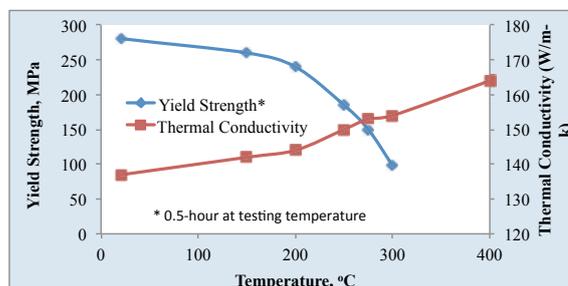
SupraCast offers castability, good thermal conductivity, high tensile strength and fatigue resistance at both low and high temperatures.

- 351: Suitable for applications such as cylinder heads, connecting rods, turbo chargers, brake calipers, and impellers.
- C677F: Designed for high-pressure die cast (HPDC) components that require high strength and fatigue performance at elevated temperature (150°C to 300°C), such as engine blocks.

# The art is in the science behind superior performance at elevated temperatures

SupraCast alloys are optimized to meet the challenging future power train requirements by eliminating conventional aluminum alloy barriers.

- Controlling the formation of the 'Q' phase by maintaining copper and magnesium at appropriate levels in the alloy.
- Using a solution heat treatment schedule based on thermodynamic calculations of the solidus temperature in the multi-component alloy system.
- Employing micro-alloying additions for optimal high temperature strength and creep resistance.



## 351 SupraCast™ Technical Data

CHEMICAL COMPOSITION (all in wt%. Single values indicate maximum content)

Si	Fe	Cu	Mn	Mg	V	Zr	Ti	Others Each	Others Total
8.0-10.0	0.20	1.3-2.1	0.08-0.6	0.25-0.55	0.08-0.30	0.08-0.30	0.20	0.05	0.15

MECHANICAL PROPERTIES\*

Alloy	TYE at Room Temperature			TYE at 300°C**			Fatigue Strength, (MPa) (R-1, 10 <sup>7</sup> Cycles)	
	Yield Strength (MPa)	UTS (MPa)	Elongation (%)	Yield Strength (MPa)	UTS (MPa)	Elongation (%)	150°C	250°C
351-T6	280-350	370-400	2-3	55	75	41	95	79
A356-T6	220	280	7	25	35	45	57	

\*The achievable mechanical properties are strongly dependent on the casting process used. The table refers typical properties obtained in semi-permanent mold castings.

\*\* Strengths were measured after 500 hours exposure at temperature.

PHYSICAL PROPERTIES (TYPICAL VALUES)

Density (g/cm <sup>3</sup> )	Young's Modulus (GPa)	Coeff. Of Thermal Expansion (CTE) 20-300°C (mm/m/K)	Thermal Conductivity [W/(mK)]	Electrical Conductivity (%IACS)	Solidification Range (°C)
2.70	72-74	20.6-28.6	140-160	32-36	595-510

OTHER PROPERTIES

- Castability: Very good, suitable for sand casting, investment and permanent mold casting
- Machinability: Very good
- Weldability: Good
- Corrosion Resistance (ASTM G110): Similar corrosion resistance as A359 alloy (the additions of Cu do not change the corrosion mode nor increase the depth of attack of the alloys).

## High Pressure Die Cast C667F SupraCast™ Technical Data

CHEMICAL COMPOSITION (all in wt%. Single values indicate maximum content)

Si	Fe	Cu	Mn	Mg	V	Zr	Ti	Others Each	Others Total
8.0-10.0	0.5	0.7-2.0	0.35-0.8	0.20-0.6	0.08-0.30	0.08-0.30	0.20	0.05	0.15

MECHANICAL PROPERTIES\*

Alloy	Yield Strength (MPa)	UTS (MPa)	Elongation (%)	Fatigue Strength, (MPa) (R-1, 10 <sup>7</sup> Cycles)	
				RT	150°C
C667F-T5	210-240	280-300	2-3	90	80
A380	160	240	2	57	50

\*The achievable mechanical properties are strongly dependent on the casting process used. The table refers typical properties obtained in high-pressure die casting (HPDC).

PHYSICAL PROPERTIES (TYPICAL VALUES)

Density (g/cm <sup>3</sup> )	Young's Modulus (GPa)	Coeff. Of Thermal Expansion (CTE) 20-300°C (mm/m/K)	Thermal Conductivity [W/(mK)]	Electrical Conductivity (%IACS)	Solidification Range (°C)
2.69	71-73	20.6-28.6	140-160	32-36	600-510

OTHER PROPERTIES

- Castability: Very good
- Machinability: Very good
- Weldability: Good
- Corrosion Resistance: Similar corrosion resistance as A359 alloy