

Level 1 Aluminum alloys

IMAGE



CAPTION

Aluminum can be formed both by casting and by deformation.

THE MATERIAL

Aluminum was once so rare and precious that the Emperor Napoleon III of France had a set of cutleries made from it that cost him more than silver. But that was 1860; today, nearly 150 years later, aluminum spoons are things you throw away—a testament to our ability to be both technically creative and wasteful. Aluminum, the first of the 'light alloys' (with magnesium and titanium), is the third most abundant metal in the earth's crust (after iron and silicon) but extracting it costs much energy. It has grown to be the second most important metal in the economy (steel comes first), and the mainstay of the aerospace industry.

COMPOSITION

Al + alloying elements, e.g. Mg, Mn, Cr, Cu, Zn, Zr, Li

GENERAL PROPERTIES

Density	2.64e3	-	2.81e3	kg/m ³
Price	*2.49	-	2.69	USD/kg

MECHANICAL PROPERTIES

Young's modulus	69	-	75	GPa
Yield strength (elastic limit)	109	-	439	MPa
Tensile strength	186	-	510	MPa
Elongation	2.5	-	14	%
Hardness—Vickers	57	-	155	HV

Fatigue strength at 10 ⁷ cycles	*68.2	-	169	MPa
Fracture toughness	*23	-	38	MPa.m ^{0.5}

THERMAL PROPERTIES

Melting point	524	-	650	°C
Maximum service temperature	99.9	-	170	°C
Thermal conductor or insulator?	Good conductor			
Thermal conductivity	121	-	187	W/m.°C
Specific heat capacity	882	-	999	J/kg.°C
Thermal expansion coefficient	21.6	-	24.6	μstrain/°C

ELECTRICAL PROPERTIES

Electrical conductor or insulator?	Good conductor			
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OPTICAL PROPERTIES

Transparency	Opaque			
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ECO PROPERTIES

Embodied energy, primary production	*186	-	205	MJ/kg
CO ₂ footprint, primary production	*12.4	-	13.7	kg/kg
Recycle	True			

SUPPORTING INFORMATION

Typical uses

Aerospace engineering; automotive engineering—pistons, clutch housings, exhaust manifolds; die cast chassis for household and electronic products; siding for buildings; foil for containers and packaging; beverage cans; electrical and thermal conductors.

Links

ProcessUniverse

*No warranty is given for the accuracy of this data. Values marked * are estimates.*