## Description

### 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 cutlery 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.
An alternative name for Aluminum in many countries is Aluminium.

### Composition (summary)

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

## General properties

| | | | | | |
|---|---|---|---|---|---|
| Density | | 2.64e3 | - | 2.81e3 | kg/m^3 |
| Price | * | 1.59 | - | 1.72 | GBP/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 | % strain |
| 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 | | | | |

## Optical properties

| | | | | | |
|---|---|---|---|---|---|
| Transparency | Opaque | | | | |

## Eco properties

| | | | | | |
|---|---|---|---|---|---|
| Embodied energy, primary production | * | 186 | - | 205 | MJ/kg |
| CO2 footprint, primary production | * | 12.4 | - | 13.7 | kg/kg |
| Recycle | ✓ | | | | |

## Supporting information

**Typical uses**

Aerospace engineering, automotive engineering - pistons, clutch housings, exhaust manifolds, sports equipment such as golf clubs and bicycles, die cast chassis for household and electronic products, siding for buildings, reflecting coatings for mirrors, foil for containers and packaging, beverage cans, electrical and thermal conductors.

## Links

ProcessUniverse