Aluminum 5052: The Marine and Sheet Metal Specialist

Metallurgical Profile

Aluminum 5052 belongs to the 5xxx series, where Magnesium (Mg) is the primary alloying element. Unlike the 6xxx or 7xxx series, 5052 is **non-heat-treatable**. It derives its strength solely from solid-solution strengthening and strain hardening (cold working). This fundamental difference gives it unique formability characteristics.[6]

Chemical Composition (Weight %)

The moderate magnesium content provides substantial strength improvement over pure aluminum (1100 series) while maintaining high corrosion resistance, particularly in saline environments.

Element	Weight Percentage (%)	Role
Magnesium (Mg)	2.20 – 2.80	Primary strengthener; imparts corrosion resistance.[31]
Chromium (Cr)	0.15 – 0.35	Improves resistance to SCC.[31]
Iron (Fe)	Max 0.40	Impurity.[31]
Silicon (Si)	Max 0.25	Impurity.[31]
Copper (Cu)	Max 0.10	Kept low to prevent galvanic corrosion.[31]
Aluminum (Al)	Remainder	Base.[31]

Mechanical Properties

The most common temper for 5052 is **H32** (Strain Hardened and Stabilized - 1/4 Hard).

Property	5052-H32	Comparison to 6061-T6	Unit
Ultimate Tensile Strength	228 (33)	~26% Weaker	MPa (ksi) [30]
Yield Strength	193 (28)	~30% Weaker	MPa (ksi) [30]
Fatigue Strength	**117 (17)**	**Higher than 6061-T6**	MPa (ksi) [30]
Shear Strength	138 (20)	Lower	MPa (ksi) [30]
Hardness (Brinell)	60 HB	Soft (vs 95 HB)	HB [30]
Elongation at Break	12%	Similar	% [33]

Insight: While 5052 is statically weaker than 6061, its **fatigue strength** (117 MPa) is surprisingly higher than 6061-T6 (96.5 MPa). This makes 5052 exceptionally durable in applications involving vibration, such as vehicle fuel tanks and marine structures.[10]

Processing Characteristics

- **Formability:** Excellent. 5052 can be bent to tight radii without cracking, unlike 6061-T6 which often cracks at 90-degree bends unless annealed. This makes 5052 the default choice for sheet metal work.[6]
- **Weldability:** Excellent. It can be welded with little loss of strength (since it's not heat-treated) and has excellent corrosion resistance in the weld zone.[9]
- **Corrosion Resistance:** Outstanding. It is virtually immune to saltwater and industrial atmospheres, often referred to as "Marine Grade".[6]
- **Machinability:** Poor. It is soft and "gummy." It produces long, stringy chips that can wrap around tooling. High rake angles and aggressive coolants are needed.[6]

Applications

- **Marine:** Boat hulls, pontoons, docks.[6]
- **Automotive:** Fuel tanks, fuel lines, truck trailers.[34]
- **Electronics:** Chassis boxes, mounting brackets, panels.[1]