

The new magnesium diecasting alloy, **AM-lite®**, offers considerable advantages over the existing general purpose diecasting alloy, AZ91D. While retaining the lightweight advantage common to all magnesium alloys, AM-lite has superior diecastability, **significantly improved as-cast surface quality** and surface definition, and is highly suitable for decorative surface finishing processes. In particular AM-lite can be **readily electroplated** in a process that is similar in cost and quality to the electroplating process that is common for diecast zinc alloys. Most significantly, **AM-lite offers considerable cost benefits over AZ91D**.

Reduced costs

Compared to AZ91D, AM-lite provides clear cost benefits in the following areas:

- Melting and melt handling
 - melt losses reduced from typically ~ 4% for AZ91D to ~ 1% for AM-lite
 - reduced use of cover gas
- Diecasting
 - improved fluidity, reduction in cross sectional area of runners
 - wider operating window, provides improved process stability for automation
 - reduced cycle time
 - reduced rejects
- Recycling
 - smaller volume of returns because of reduced runner cross sectional area
 - in-cell recycling of class 1 scrap possible
- Surface finishing
 - improved as-cast surface, reduced buffing and polishing
 - mirror finish achievable on as-cast surfaces
 - electroplatable using processes compatible with existing electroplating operations
- Design
 - thinner, more detailed parts
 - thinner bosses in bolted sections
 - reduced material consumption



Electroplated AM-lite diecastings

Case study: projected savings for a PDA case diecast with AM-lite®

Operation	Saving with AM-lite
Diecasting	
Thickness of part	20% reduction
Yield	3% improvement
Cost of diecasting	20-30% cost saving
Finishing	
Putty/filler	eliminated
Buffing/polishing	75% saving
Painting	same
Total cost of painted part	50% cost saving
Electroplating*	
Buffing/polishing	75% saving
Electroplating	50% saving
Total cost of electroplated part	50% cost saving



Dimensions 75 x 120mm

* Quality of electroplating on AZ91D is insufficient for this application

AM-lite® can be electroplated

AM-lite can be readily electroplated to produce a variety of decorative surface finishes. This is because the high quality as-cast surface finish reduces the amount of buffing, or polishing, that is necessary and the surface chemistry of AM-lite provides excellent adhesion of deposited layers. A unique pre-treatment, Bondal® Mg, has been developed especially for AM-lite by MacDermid Inc. Electroplating of AZ91D is considerably more difficult and expensive because of the relatively complex pre-treatment process and high rate of defects.

Comparison with Magnesium Alloy AZ91D

Melt handling

Compared to AZ91D, AM-lite:

- produces significantly less dross and sludge
 - typical melt loss for AZ91D is ~4%, melt loss for AM-lite is ~1%
- requires less cover gas
- burns less during removal of dross and sludge
- exhibits less burning of magnesium on tools
- produces significantly less fume in the diecasting foundry
- in-cell recycling of diecasting returns (biscuits, runners and gates) is possible with AM-lite.

Diecasting

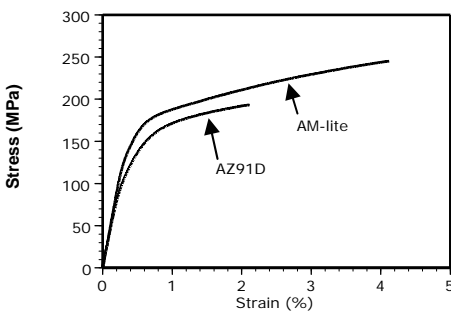
AM-lite has considerably improved diecastability compared with AZ91D. As a result thinner and more detailed castings can be produced. Because of the increased fluidity of AM-lite the cross sectional area of runners can be reduced by 25%. While AM-lite can be readily cast into dies that have been designed for AZ91D, the reduced runner size allows improved thermal design of dies that results in cycle times being reduced by about 20%.

The operating window for diecasting of AM-lite is considerably wider than for AZ91D. This provides for greater stability in production and more effective automation with fewer defects.

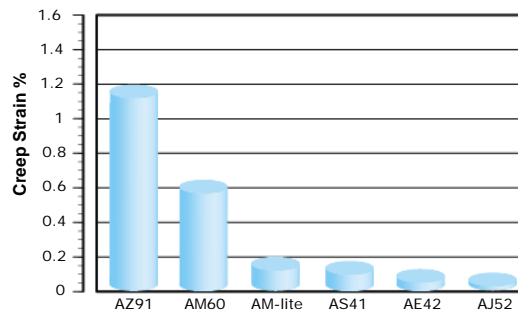
Properties

Property*	AZ91D	AM-lite	Comment	
Density	1.8 g/cm ³	2.0 g/cm ³	AM-lite has slightly higher density, but strength and castability allow lighter designs.	
Young's modulus	44 MPa	45.3 MPa	Slightly higher.	
Yield stress (0.2% proof)				
2mm thick	120 - 150 MPa	160 - 170 MPa	AM-lite is higher. Actual value is dependent on section thickness and casting conditions.	
10mm thick	~ 110 MPa	110 - 120 MPa		
Ultimate tensile strength				
2mm thick	180 - 205 MPa	230 - 250 MPa	AM-lite is generally higher. Actual value is dependent on section thickness and casting conditions.	
10mm thick	190 - 230 MPa	200 - 220 MPa		
Tensile ductility	2mm thick	3-4%	3-4%	Similar. Dependent on casting conditions.
Elastic limit	2mm thick	~ 40 MPa	~ 100 MPa	AM-lite is linear elastic to much higher stresses.
Creep strain (36MPa, 150°C, 200h)	1.2%	0.2%	AM-lite has significantly higher creep strength.	
Corrosion (mass loss, 5 day, ASTM salt spray)	0.1-0.4 mg.cm ² day ⁻¹	0.2 mg.cm ² day ⁻¹		

* properties determined using samples of AZ91D and AM-lite excised from 2mm thick diecastings



Tensile curves for 2mm plates



Creep strain after 200h at 150°C and 35 MPa

Improved lightweight design

Thinner, more detailed parts can be designed in AM-lite because of its higher strength and significantly higher elastic limit combined with its ability to be cast into thin sections with high reproducibility of die detail. Bosses for bolted sections can be made thinner because of AM-lite's higher room temperature strength and much higher creep strength.

Surface finishing

The high quality as-cast surface of AM-lite diecastings provides a much better substrate than AZ91D for all surface finishing operations. Mirror finishes are possible on AM-lite diecastings. Unlike AZ91D, as-cast surfaces of AM-lite are resistant to oxidation providing a longer shelf life for unfinished castings. Expensive polishing and buffing operations that are needed for AZ91D can be substantially reduced or eliminated with AM-lite. Blister defects in baking operations are significantly reduced or eliminated.

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Further information on AM-lite® can be obtained from Advanced Magnesium Technologies.