

# **Material Properties of Magnesium**

**Randy Beals**

**(A)**  
**Friendly**  
**Material**  
**Properties**

# Physical/Chemical Properties of Mg vs Other Matl's

PROPERTY	Units	Condition	AZ91	AM60	Al380 DC	Al A356 T6	Nylon 30% glass	ABS
Sg Gravity	g/cm <sup>3</sup>		1.81	1.79	2.74	2.69	1.4	1.05
Th Conductivity	W/m <sup>o</sup> K		51	61	96	159	0.33	0.28
Coeff Th Expan	um/m <sup>o</sup> K		26	25.6	22	21.5	34.5	76.5
Specific Heat	J/L <sup>o</sup> K		1,900		2,640	2,590		
Heat of Fusion	kJ/L		673		1,066			
Freezing Range	°C		470-595	540-615	540-595	555-615		
Corrosion wt. loss 3 days@5% NaCl	mg/cm <sup>2</sup> /d	die cast	0.02	0.05	0.27			

# Mechanical Properties of DC Mg vs Other Matl's

PROPERTY	Units	Condition	AZ91	AM60	Al380 DC	Al A356 T6	Nylon 30% glass	ABS
UTS	MPa	Ambient	230	220	320	262	195	45
YS (tensile)	MPa	Ambient	150	130	160	185	170	40
(comp)	MPa		165	130		186		
Shear Str	MPa		140		214	205		
RB Fatigue St	MPa	5 x 10 <sup>8</sup> cyc	82	60	145	90		
0.1% Creep St	MPa	125°C	34	34	135			
after 100 hrs								
Impact St Unnotch	Joules		6	22	3.5	11		
Notched	Joules		1.5	3.2				
Elongation	%		3	8 to 15	4	5	8	17
EI Modulus	GPa	Ambient	45	45	72	73	8.9	2.1
Shear Modulus	GPa	Ambient	14		27	28		
Brinell Hardness			65	60	80	80		
Damping Capacity	%	35 MPa	29	52		1.2		
Possions Ratio			0.35	0.35	0.33			

- **2/3 Density Al, 1/4 Steel**
- **30 x Damping vs Al**
- **200 x Th Cond vs PI**
- **1/2 Th Expansion vs PI**

- **Higher Specific Strength  
Ductility and  
Impact Strength  
vs HPDC Al.**
- **Higher Stiffness vs  
Plastic.**
- **Higher Machinability vs  
Al.**

**(B)**

**Less Friendly  
Material  
Properties**





# Mechanical Properties of DC Mg vs Other Matl's

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# **Processing Advantages of Mg**

## **Vs Aluminum**

- **2/3 Latent Heat/volume.  $\frac{3}{4}$  Specific Heat.  
Lower Fe Solubility.....**
- **2/3 Melting cost . 25% Higher productivity.  
1/2 Die life**
- **Higher Fluidity.....**
- **Thinner walls (~ 0.8 mm). Complex  
shape capability. Unique features can  
be cast. Lower draft angles**

- **Higher dimensional stability vs polymers**
- **Higher tolerances vs aluminum**
- **This enhanced castability of magnesium makes it highly suitable for large die cast components**