Zamak

Commercial name for a zinc base alloy with aluminum, copper and magnesium. Versatile material used to obtain die casting pieces in high volumes with high precision and detail reproductibility eliminating machining and reducing costs.

Chemical properties

DESIGNATION	ABBREV.	ALLOY	Weight	Aluminium (Al)	Magnesium (Mg)	Copper (Cu)	Lead (Pb)	Cadmium (Cd)	Tin (Sn)	Iron (Fe)	Nickel (Ni)	Silicium (Si)	Titanium (Ti)	Chromium (Cr)	Zinc (Zn)
ZAMAK 2	ZL2	ZnAl4Cu3	min.	3,8	0,035	2,7	---	---	---	---	---	---	---	---	rest.
			max.	4,2	0,06	3,3	0,003	0,003	0,001	0,02	0,001	0,02	---	---	rest.
ZAMAK 3	ZL3	ZnAl4	min.	3,8	0,035	0,7	---	---	---	---	---	---	---	---	rest.
			max.	4,2	0,06	1,1	0,003	0,003	0,001	0,02	0,001	0,02	---	---	rest.
ZAMAK 5	ZL5	ZnAl4Cu1	min.	3,8	0,035	0,7	---	---	---	---	---	---	---	---	rest.
			max.	4,2	0,06	1,1	0,003	0,003	0,001	0,02	0,001	0,02	---	---	rest.
ZAMAK 6	ZL6	ZnAl6Cu1	min.	5,6	---	1,2	---	---	---	---	---	---	---	---	rest.
			max.	6,0	0,005	1,6	0,003	0,003	0,001	0,02	---	0,02	---	---	rest.
ZAMAK 8	ZL8	ZnAl8Cu1	min.	8,2	0,02	0,9	---	---	---	---	---	---	---	---	rest.
			max.	8,8	0,03	1,3	0,005	0,005	0,002	0,035	0,001	0,035	---	---	rest.
ZAMAK 12	ZL12	ZnAl11Cu1	min.	10,8	0,02	0,5	---	---	---	---	---	---	---	---	rest.
			max.	11,5	0,03	1,2	0,005	0,005	0,002	0,05	---	0,05	---	---	rest.
ZAMAK 16	ZL16	ZnCu1CrTi	min.	0,01	---	1,0	---	---	---	---	---	---	0,15	0,1	rest.
			max.	0,04	0,02	1,5	0,005	0,005	0,003	0,04	---	0,04	0,25	0,2	rest.
ZAMAK 27	ZL27	ZnAl27Cu2	min.	25,5	0,012	2,0	---	---	---	---	---	---	0,15	0,1	rest.
			max.	28,0	0,02	2,5	0,005	0,005	0,002	0,07	---	0,04	0,25	0,2	rest.

Physical properties

	ZAMAK 2	ZAMAK 3	ZAMAK 5	ZAMAK 8	ZAMAK 12	ZAMAK 27
Density (Kg/m^3) at 21 º C	6,7	6,7	6.7	6,3	6,0	5,0
Solidification shrinkage (%)	1,25	1,17	1,17	1,1	0,7	0,75
Casting shrinkage (%)	0,6	0,6	0,6	0,7	0,7	0,75
Freezing range (0)	379 , 390	381 , 387	379 , 388	375 , 404	377 , 432	376 , 484
Casting temperature	420 , 425	400 , 420	400 , 420	415 , 430	470 , 530	550 , 580
Specific heat capcity (J/kg/ʃC) at 20 - 100 ™C	418,7	418,7	418,7	435,4	450	534,4
Thermal expansion (10E-6 linear per ʃC at 20-100 ʃC)	27	27	27	23,3	24,2	26,2
Thermal conductivity (W/m/hr/m^2/ ʃC at 70-140ʃC)	104,7	113	108,9	114,7	116	125,5
Electrical conductivity % (IACS)	25	27	26	27,7	28,3	29,7
Electrical resitivity (µm O cm at 20ʃC)	6,3694	6,3694	6,5359	6,2	6,1	5,8

Mechanical properties

ZAMAK 2	As cast	Aged	Sand Cast
Tensile strength (MPa)	360	331	252
Shear Strength (Mpa)	317	214	227
Elongation (% in 51 mm)	7	2	3
Hardness (Brinell - 500 kg)	100	98	100
Impact strength (Energy , Joules)	47	68	7,4
Fatigue strengh 5x10E8 cycles (Mpa)	58,6	---	0
Yield strength (0,2% offset) (Mpa)	---	---	---

ZAMAK 3	As cast	Aged	Sand Cast
Tensile strength (MPa)	252	283	241
Shear Strength (Mpa)	227	214	---
Elongation (% in 51 mm)	3	10	16
Hardness (Brinell - 500 kg)	100	82	72
Impact strength (Energy , Joules)	7,4	58,3	55,6
Fatigue strengh 5x10E8 cycles (Mpa)	56,5	---	---
Yield strength (0,2% offset) (Mpa)	0	47,6	---

ZAMAK 5	As cast	Aged	Sand Cast
Tensile strength (MPa)	328	269	---
Shear Strength (Mpa)	262	---	---
Elongation (% in 51 mm)	7	13	---
Hardness (Brinell - 500 kg)	91	80	---
Impact strength (Energy , Joules)	65,1	54,2	---
Fatigue strengh 5x10E8 cycles (Mpa)	56,5	---	---
Yield strength (0,2% offset) (Mpa)	---	---	---

ZAMAK 8	As cast	Aged	Sand Cast
Tensile strength (MPa)	375	300	220÷225
Shear Strength (Mpa)	275	227	241
Elongation (% in 51 mm)	6÷10	20	1÷2
Hardness (Brinell - 500 kg)	100÷106	91	85÷90
Impact strength (Energy , Joules)	42	17	---
Fatigue strengh 5x10E8 cycles (Mpa)	103	---	52
Yield strength (0,2% offset) (Mpa)	240	240	210

ZAMAK 12	As cast	Aged	Sand Cast
Tensile strength (MPa)	404	310	275÷317
Shear Strength (Mpa)	296	241	207
Elongation (% in 51 mm)	4÷7	10	1÷2
Hardness (Brinell - 500 kg)	100÷106	91	92÷96
Impact strength (Energy , Joules)	42	17	25
Fatigue strengh 5x10E8 cycles (Mpa)	103	---	103
Yield strength (0,2% offset) (Mpa)	320	241	207

ZAMAK 27	As cast	Aged	Sand Cast
Tensile strength (MPa)	426	360	400÷441
Shear Strength (Mpa)	325	257	290
Elongation (% in 51 mm)	2÷3	2÷3	3÷6
Hardness (Brinell - 500 kg)	116÷122	100	110÷120
Impact strength (Energy , Joules)	5	2,2	47
Fatigue strengh 5x10E8 cycles (Mpa)	145	---	172
Yield strength (0,2% offset) (Mpa)	371	317	372

Some uses of zamak

Automotive, Bathroom fittings, Office items, Faucet, Locks, Hardware

Bibliography about zamak

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  William A. Cannon

- *"Metalcasting"*
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- *"Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention, 2nd Edition"*
  by Jack A. Collins

- *"Alloy data"*
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- *"The diecasting of Zamak"*
  Luigi Andreoni

- *"Replacement of steel with scratched Zamak for metal finiching decorative purposes"*