

Supplementary Data

Supplementary Table 1 Nominal alloy compositions as verified by EDS

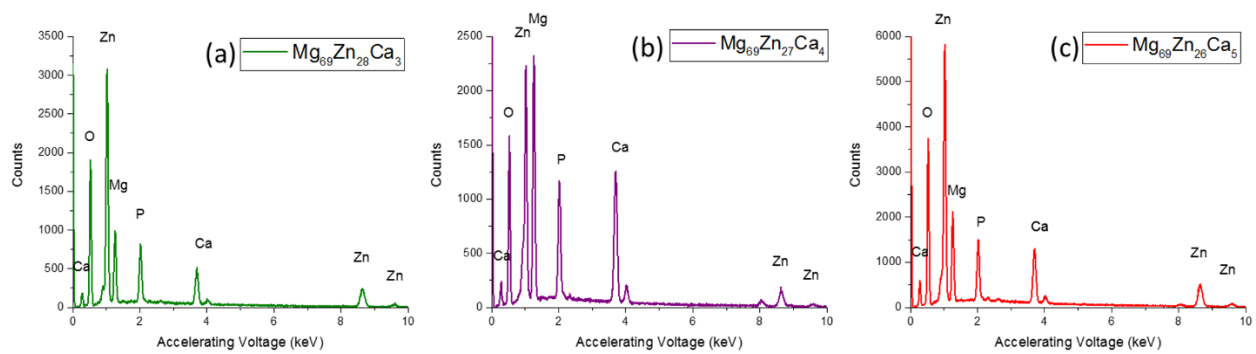
Composition	Mg (at.%)	Zn (at.%)	Ca (at.%)
Mg ₆₆ Zn ₃₀ Ca ₄	66.2	29.3	4.5
Mg ₆₉ Zn ₂₆ Ca ₅	68.9	25.5	5.6
Mg ₆₉ Zn ₂₇ Ca ₄	69.2	26.4	4.4
Mg ₆₉ Zn ₂₈ Ca ₃	69.3	27.4	3.3
Mg ₇₂ Zn ₂₄ Ca ₄	71.9	23.7	4.4

Supplementary Table 2 Representative values extracted from EIS equivalent circuit fitting for $Mg_{66}Zn_{30}Ca_4$

Time (h)	R_s ($\Omega \cdot cm^2$)	L_B ($H \cdot cm^2$)	C_B ($\mu F/cm^2$)	R_{CT} ($\Omega \cdot cm^2$)	Q_{DL} ($\mu F \cdot s^{(a-1)}/cm^2$)	A (Q_{DL})	R_F ($\Omega \cdot cm^2$)	W ($\Omega \cdot cm^2 \cdot s^{-1/2}$)
Initial	16	211544	-	14340	35	0.69	392	28405
1	15	30165	-	8973	15	0.73	1444	60374
4	16	25171	-	6253	2	0.88	417	20174
8	17	25405	-	6449	1	0.85	921	24169
24	17	-	0.12	5324	13	0.61	5944	6860
32	16	-	0.15	3803	29	0.62	6883	2618
48	19	-	0.19	5234	25	0.65	3918	1893

Supplementary Table 3 Representative values extracted from EIS equivalent circuit fitting for $Mg_{72}Zn_{24}Ca_4$

Time (h)	R_s ($\Omega \cdot cm^2$)	C_b ($\mu F/cm^2$)	R_{ct} ($\Omega \cdot cm^2$)	Q_{dl} ($\mu F \cdot s^{(a-1)}/cm^2$)	a (Q_{dl})	R_f ($\Omega \cdot cm^2$)	W ($\Omega \cdot cm^2 \cdot s^{-1/2}$)
Initial	19	0.23	4837	15	0.62	125	6671
1	20	0.18	1816	10	0.62	263	3767
4	20	0.08	894	11	0.62	235	2098
8	19	0.08	1353	9	0.62	270	2790
24	21	0.14	696	65	0.50	213	860
32	23	0.10	590	73	0.54	153	551
48	24	0.00	562	200	0.50	172	273



Supplementary Figure 1 EDS spectra of (a) $Mg_{69}Zn_{28}Ca_3$, (b) $Mg_{69}Zn_{27}Ca_4$ and (c) $Mg_{69}Zn_{26}Ca_5$ for the images and EDS maps given in Figure 9