Electronic Supplementary Information

$CoSe_2$ hollow microspheres, nano-polyhedrons and nanorods as pseudocapacitive Mg-storage materials with fast solid-state Mg^{2+} diffusion kinetics

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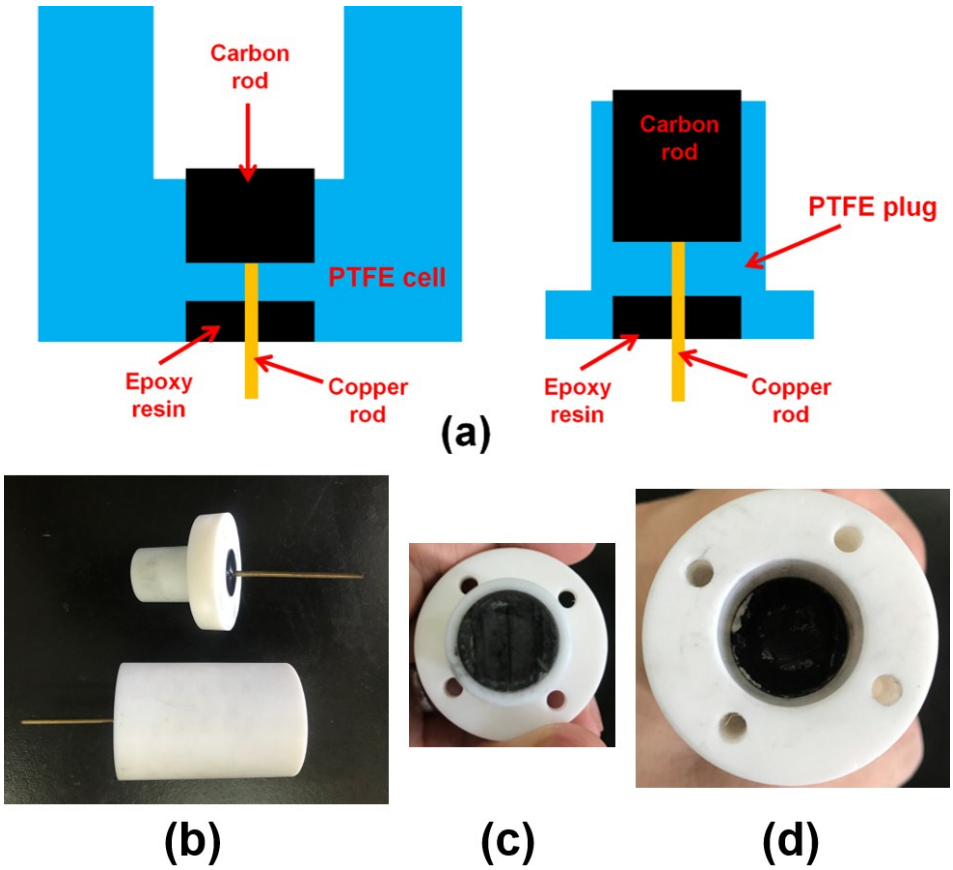

Fig. S1 (a) Schematic drawing and (b, c, d) photos of the lab-made PTFE cell used for Mg cell tests. The cell is made of PTFE cell body and carbon rod electrode. The crack is sealed with epoxy resin. PTFE tape is used for sealing during cell fabrication.

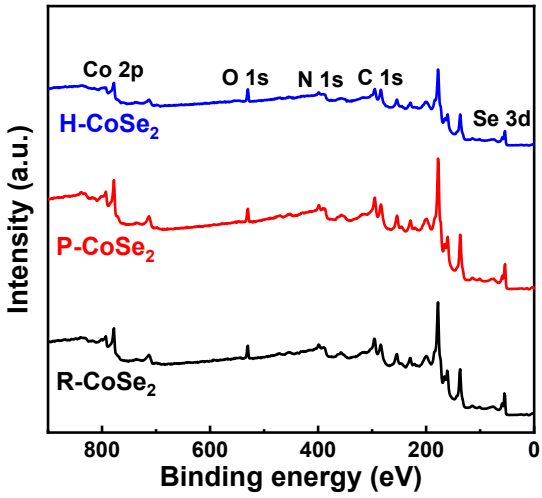

Fig. S2 Overall XPS spectra of H-$CoSe_2$, P-$CoSe_2$ and R-$CoSe_2$.

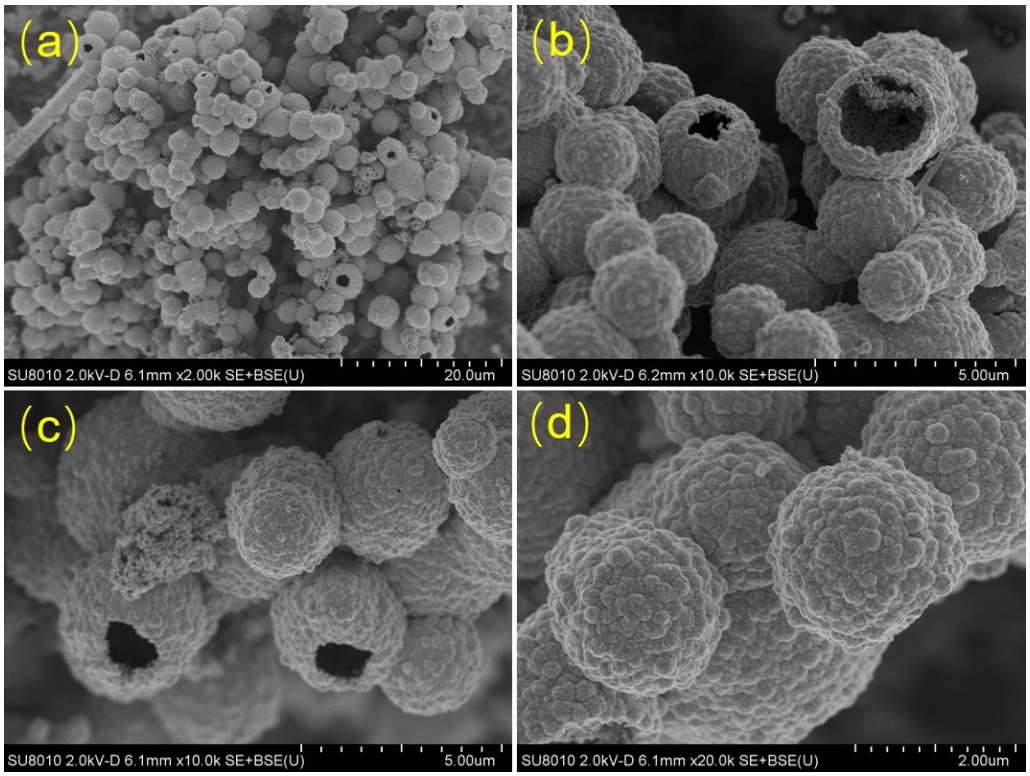

Fig. S3 SEM images of H-$CoSe_2$.

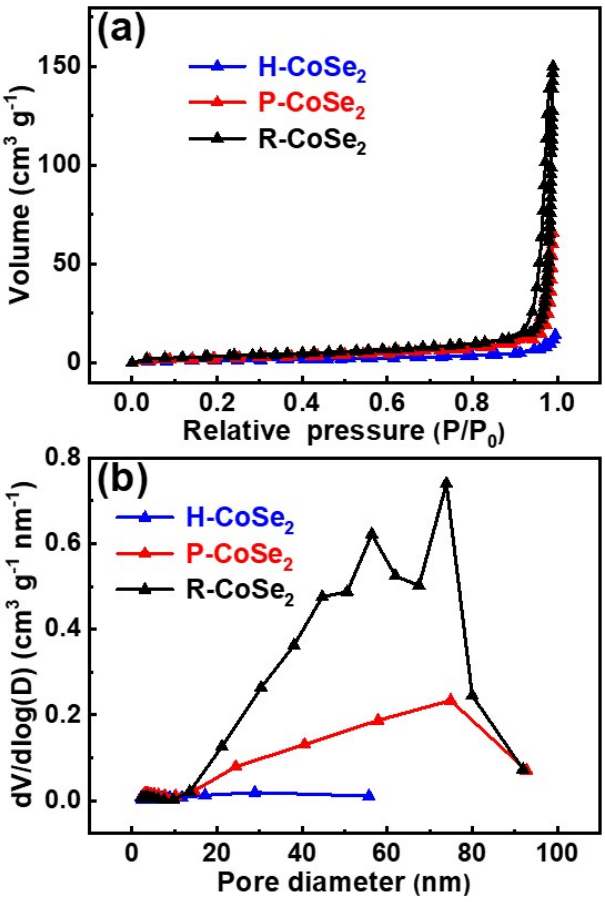

Fig. S4 (a) N_2 adsorption-desorption isotherms and (a) pore size distribution curves of H-$CoSe_2$, P-$CoSe_2$ and R-$CoSe_2$.

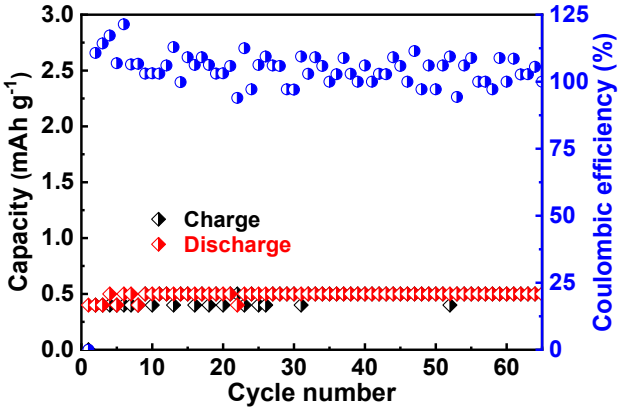

Fig. S5 Cycling performance of a blank carbon cloth in Mg cells at 50 mA g^{-1}. The capacity is calculated by the mass of $CoSe_2$ for a better comparison.

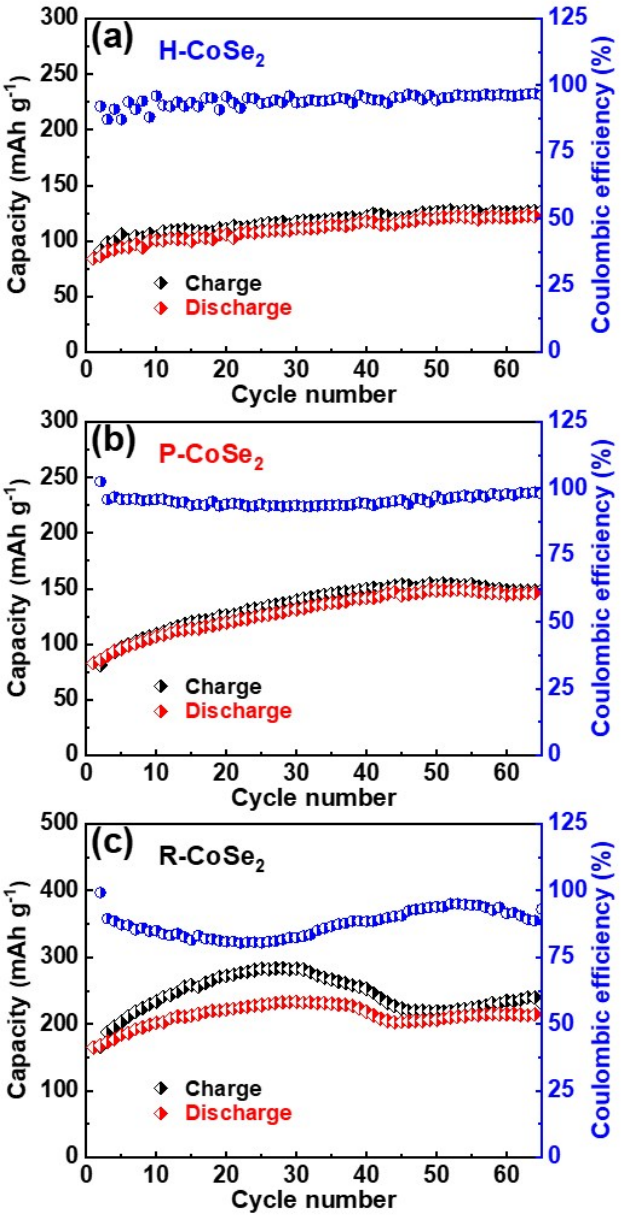

Fig. S6 Cycling performance of (a) H-$CoSe_2$, (b) P-$CoSe_2$ and (c) R-$CoSe_2$ at 50 mA g^{-1}.

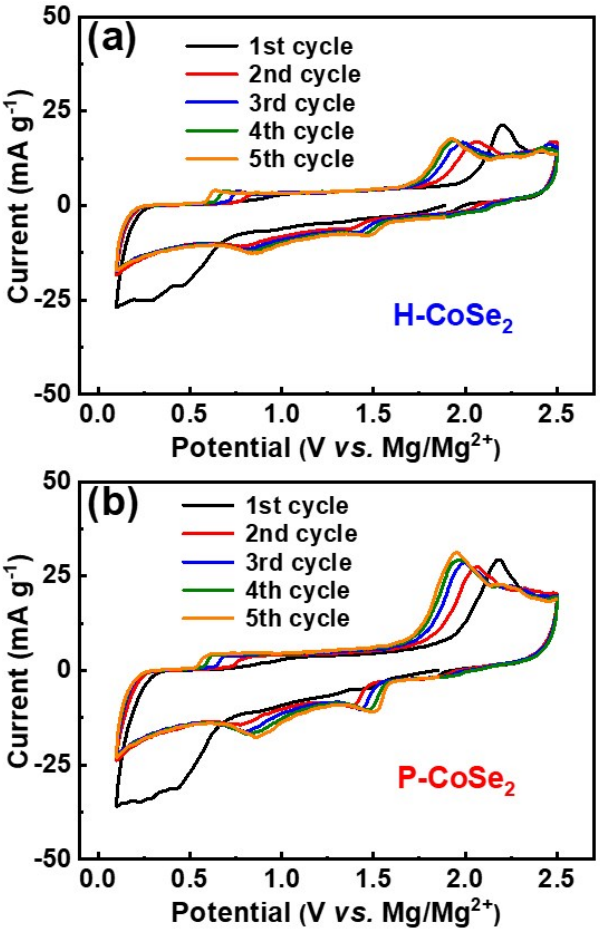

Fig. S7 CV curves of (a) H-$CoSe_2$ and (b) P-$CoSe_2$ at a scan rate of 0.1 mV s^{-1}.

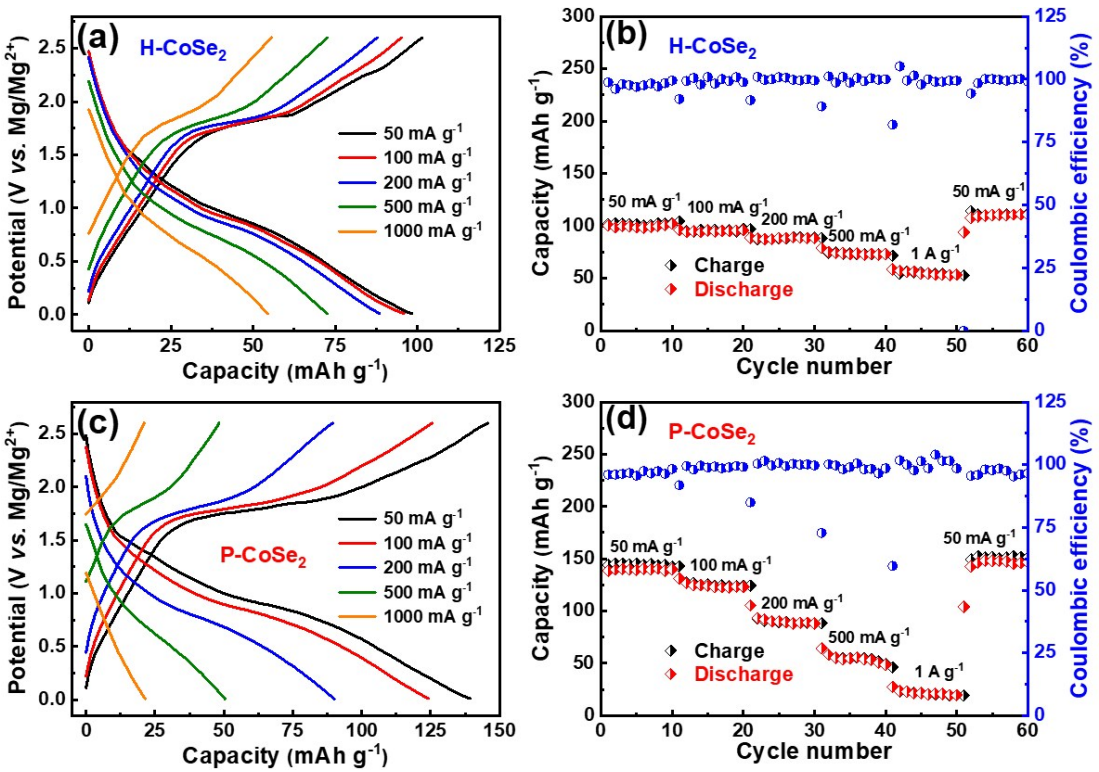

Fig. S8 Typical discharge/charge profiles of (a) H-$CoSe_2$ and (c) P-$CoSe_2$ and rate capability of (b) H-$CoSe_2$ and (d) P-$CoSe_2$ at different current densities varies from 50 to 1000 mA g^{-1}.

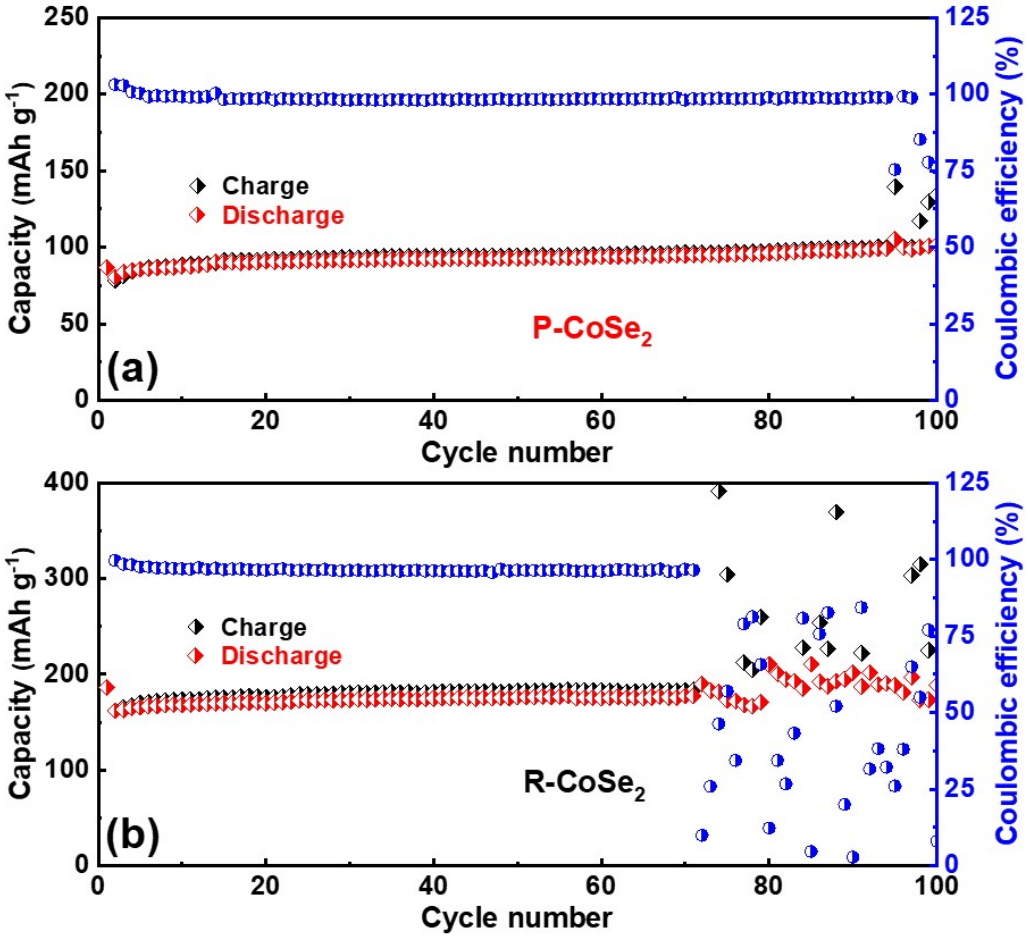

Fig. S9 Long-term cycling performance of (a) P-$CoSe_2$ and (b) R-$CoSe_2$ at 200 mA g^{-1}.

Table S1 Results of diffusion coefficient of Mg^{2+} calculated by CV measurements.

	H-$CoSe_2$		**P-$CoSe_2$**		**R-$CoSe_2$**	
peak	$I_p/v^{1/2}$	***D*** **(cm² s⁻¹)**	$I_p/v^{1/2}$	***D*** **(cm² s⁻¹)**	$I_p/v^{1/2}$	***D*** **(cm² s⁻¹)**
0.85 V	0.00644	7.7×10^{-13}	0.01269	3.0×10^{-12}	0.01778	5.9×10^{-12}
1.50 V	0.00449	3.7×10^{-13}	0.01669	5.2×10^{-12}	0.02327	1.0×10^{-11}
1.90 V	0.00779	1.1×10^{-12}	0.02065	7.9×10^{-12}	0.02327	1.0×10^{-11}