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Enhancing the coercivity of $SmCo_5$ through particle size control

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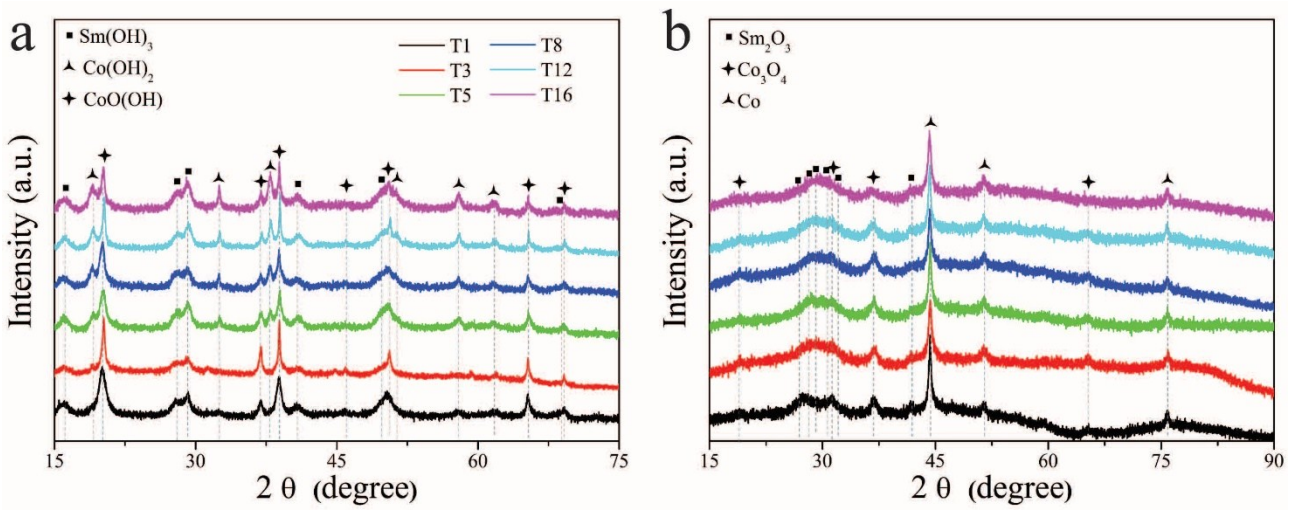

Figure S1 XRD patterns of different precursors (a) and H_2-precursor (b). The different phases are identified by the JCPDS-PDF cards (NO.06-0117, $Sm(OH)_3$; NO.02-0925, $Co(OH)_2$; NO. 26-1107, CoO(OH); Sm_2O_3; NO.25-1071; NO.42-1467, Co_3O_4; NO.150806, Co). As the XRD measurement was done in the air, the surface of Co nanoparticles was oxidized slightly, resulting in the small peaks of Co_3O_4.

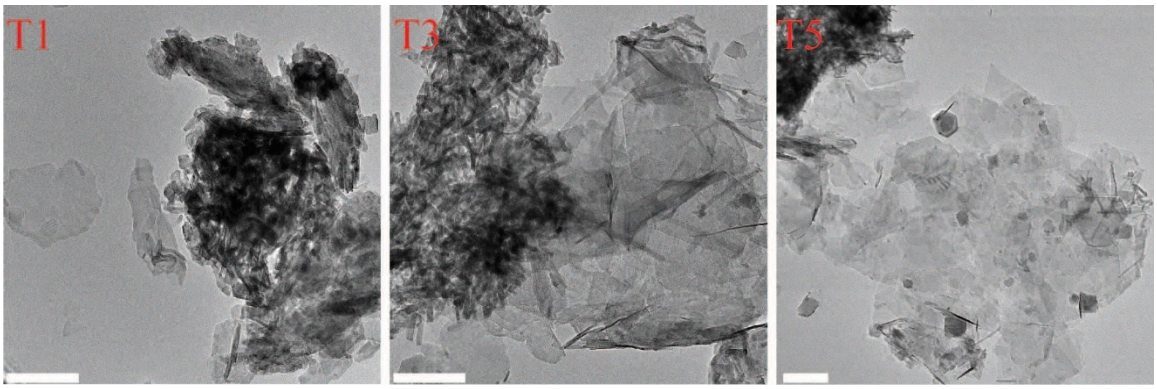

Figure S2 TEM images of T1, T3, and T5 precusors, the scale bar is 100 nm.

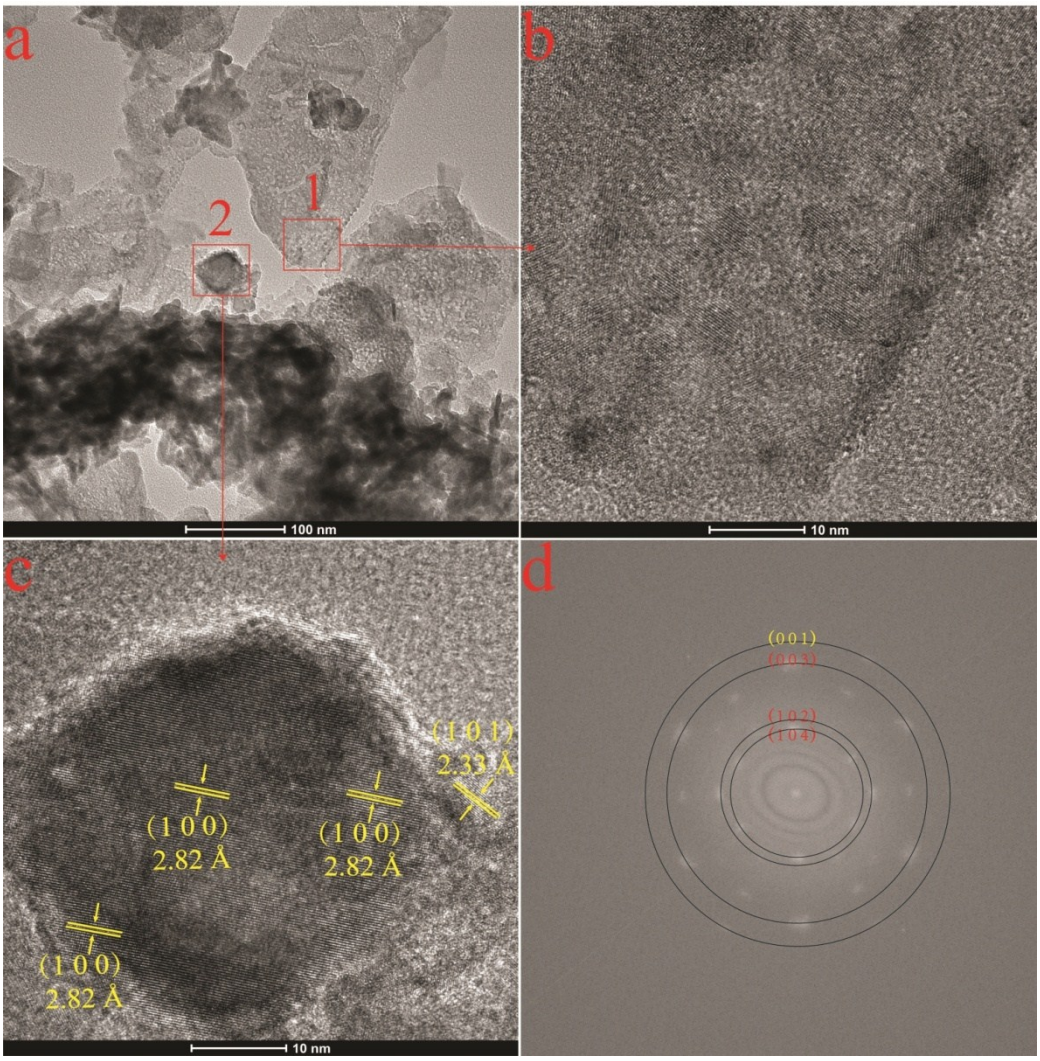

Figure S3 HRTEM images of T8 precursor in another region including the thin and thick nanoplates on the same time. (a) The overview TEM image. (b) and (c) The HRTEM images of region 1 (thin plate) and region 2 (thicker plate). The region 1 has multiple lattice fringes, and in order to avoid repeating measurements, we did the FFT (Fast Fourier Transform) of this region to obtain reciprocal lattices (d). It includes the (003), (102), and (104) planes of CoO(OH) phase indicated by red color and the (001) plane of $Co(OH)_2$ phase indicated by yellow color. The region 2 includes a d-spacing of 2.82 Å and a d-spacing of 3.33 Å, corresponding to the (100) and (101) planes of $Co(OH)_2$, respectively.

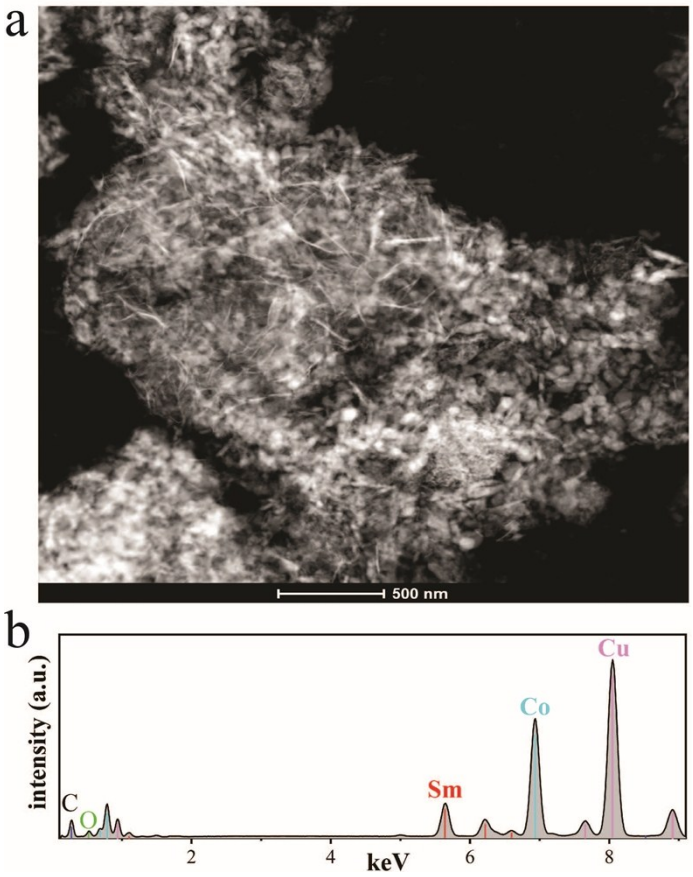

Figure S4 (a) Scanning transmission electron microscopy (STEM) image of H_2-precursor (T8 sample). (b)

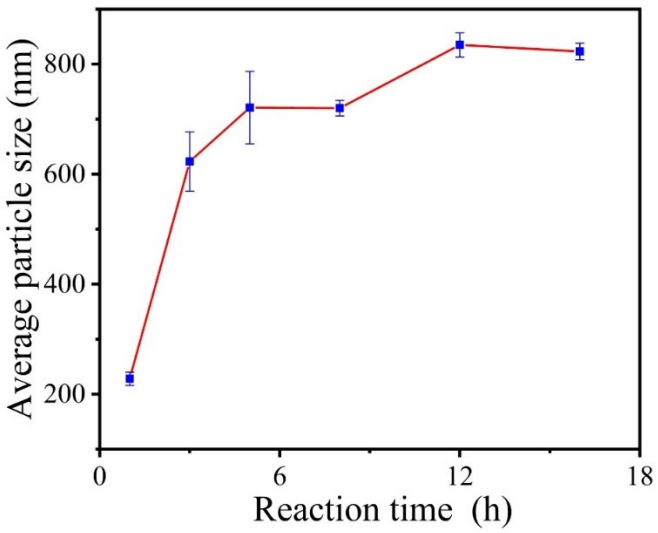

Figure S5 The trend of mean particle size with increasing reaction time

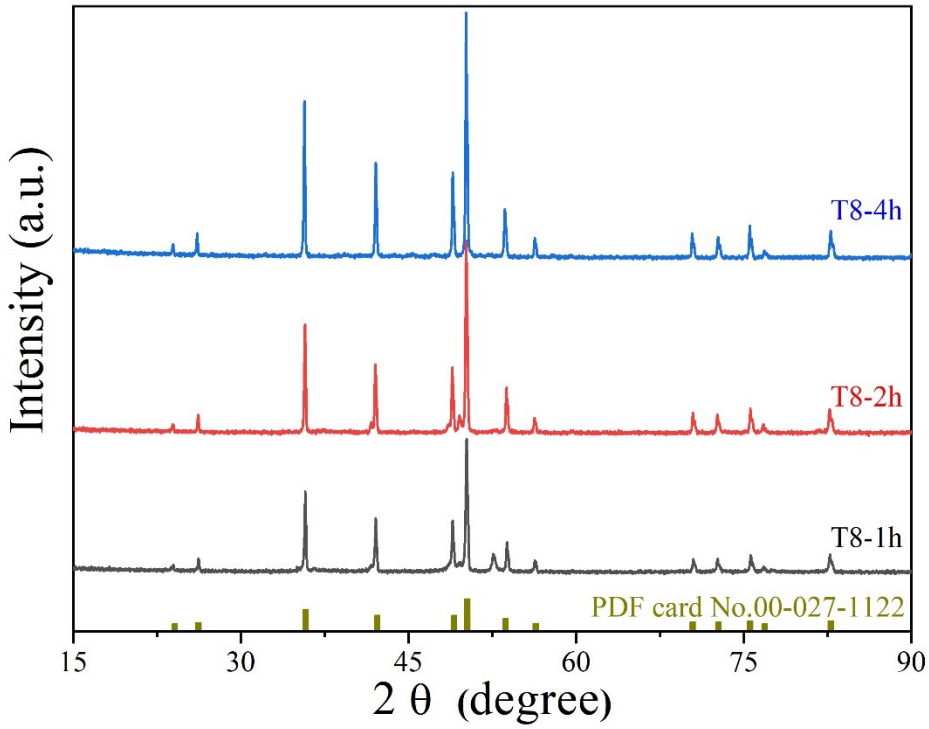

Figure S6 XRD patterns of SmCo5 particles with longer sintering time at 900 °C.

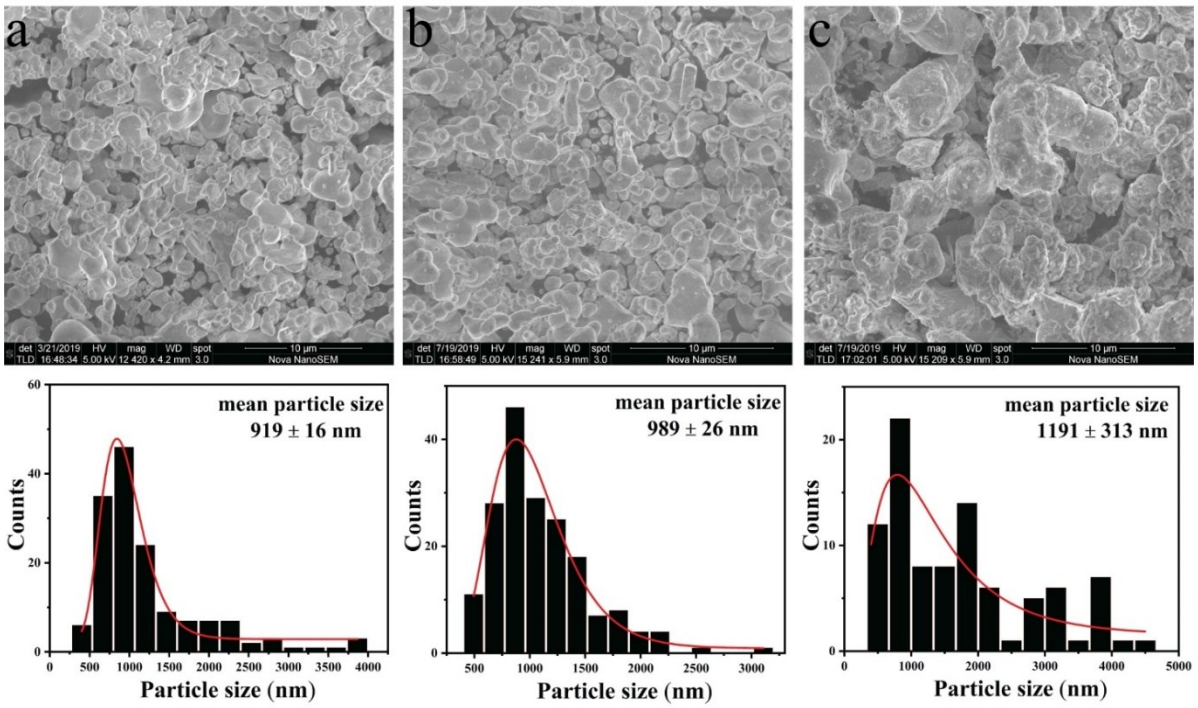

Figure S7 The characterization of $SmCo_5$ particles with longer sintering time at 900 °C. The sintering time for all samples is 0.5 h in this work, but we want to make particles grow with a big mean particle size. (a) The SEM image of T8 sample sintered for 1h. (b) The SEM image of T8 sample sintered for 2h. (c) the SEM image of T8 sample sintered for 4h. The corresponding particle size distributions are displayed in the second column. The mean particle size is calculated from fitted data using a lognormal function, plotted by a red line.

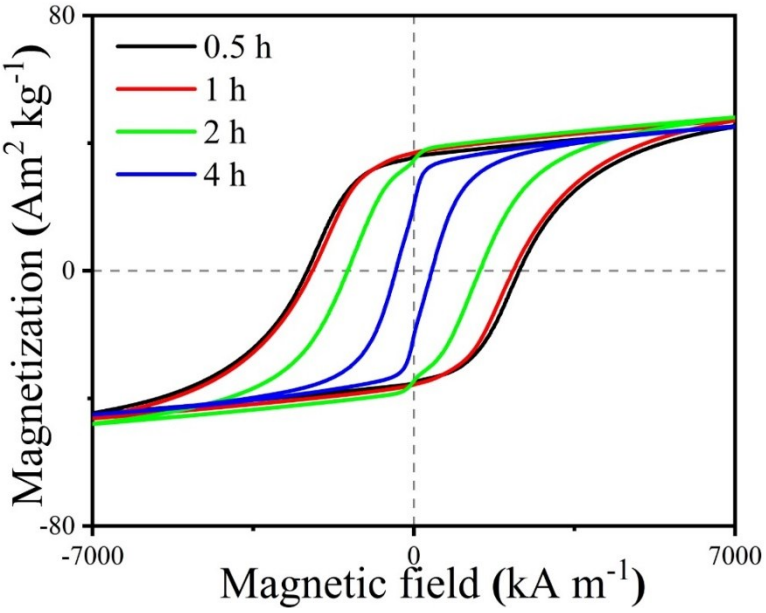

Figure S8 Hysteresis loops of T8 sample sintered at 900 °C for different time (1h, 2h, and 4h).

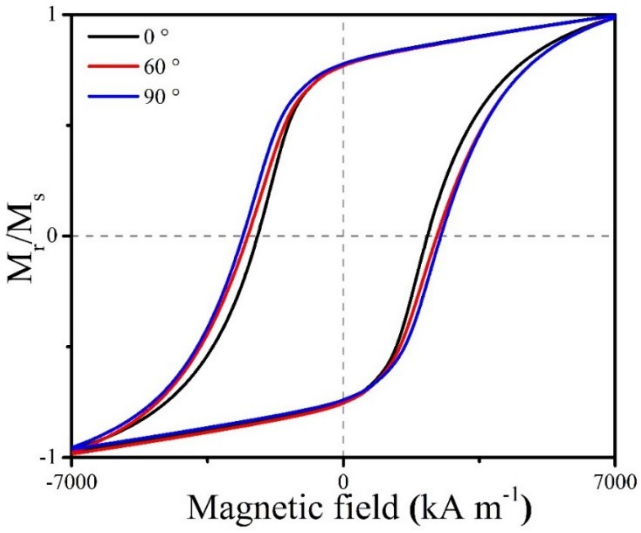

Figure S9 Hysteresis loops of T8 sample measured at varied angles between the pressing direction and magnetic field direction.

Table S1 the refined values for weight fractions of different phases, unit cell parameters, and reliable factors for all samples are listed in this table. The R_{wp} values of T1 and T3 samples are much higher than other samples due to the exiting of multiple impurity phases.

	Phase	**Weight fraction (wt. %)**	**Unit Cell Parameters (Å)**		**R_f (%)**	**R_{bragg} (%)**	**R_{wp} (%)**
			a=b	**c**			
T1	$SmCo_5$	63.8(4)	4.99366(8)	3.96791(8)	5.2	6.0	10.1
	Sm_2Co_{17}	28.1(3)	8.41167(22)	12.21187(60)	16.7	23.1	
	Sm_2Co_7-R	8.1(3)	5.03202(32)	36.39871(500)	25.4	29.9	
T3	$SmCo_5$	72.3(9)	4.98810(8)	3.97121(8)	4.7	6.6	11.4
	Sm_2Co_{17}	17.1(7)	8.40620(41)	12.22940(126)	19.1	25.1	
	Sm_2Co_7-H	5.2(4)	4.67503(48)	24.74645(568)	30.6	36.8	
	$SmCo_7$	5.4(4)	4.87174(37)	4.12466(65)	15.7	21.5	
T5	$SmCo_5$	83.5(8)	4.99888(6)	3.95962(5)	3.3	3.6	6.9
	Sm_2Co_7-R	16.5(4)	5.03379(16)	36.39214(237)	18.7	17.6	
T8	$SmCo_5$	90.2(6)	4.99554(5)	3.95959(5)	4.0	4.9	6.5
	Sm_2Co_7-R	9.8(5)	5.02677(36)	5.02677(532)	29.9	27.8	
T12	$SmCo_5$	100.0(5)	4.99245(5)	3.96152(4)	3.5	3.6	5.3
T16	$SmCo_5$	100.0(5)	4.98589(6)	3.96274(5)	4.4	3.2	5.3