Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

General Synthesis of Rare-Earth Orthochromites with Quasi-Hollow Nanostructures and Their Magnetic Properties

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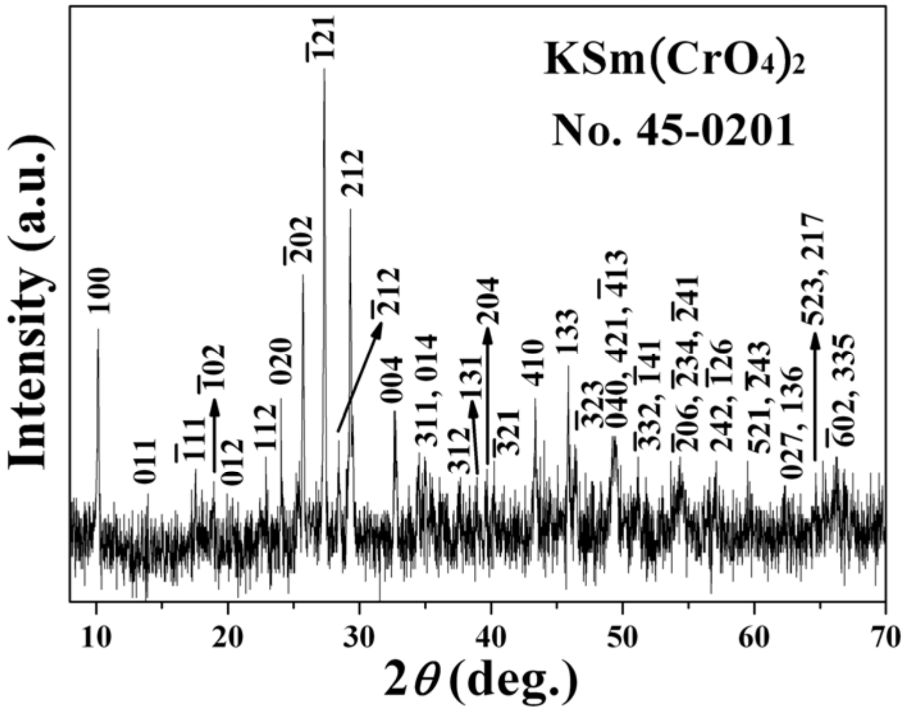

Figure S1. XRD patterns of the sample prepared by the direct reaction of K_2CrO_4 and $Sm(NO_3)_3$ aqueous solution at room temperature followed with annealing at 400 ^oC in nitrogen ambient.

All the diffraction peaks can be indexed to the monoclinic structure of $KSm(CrO_4)_2$ with lattice constants of a = 8.682 Å, b = 7.351 Å, c = 10.873 Å and β = 91.83^o, which are in good agreement with the literature values (JCPDS Card File No. 45-0201, a = 8.673 Å, b = 7.346 Å, c = 10.903 Å and β = 91.89^o). No characteristic diffraction peaks due to other impurities can be observed.

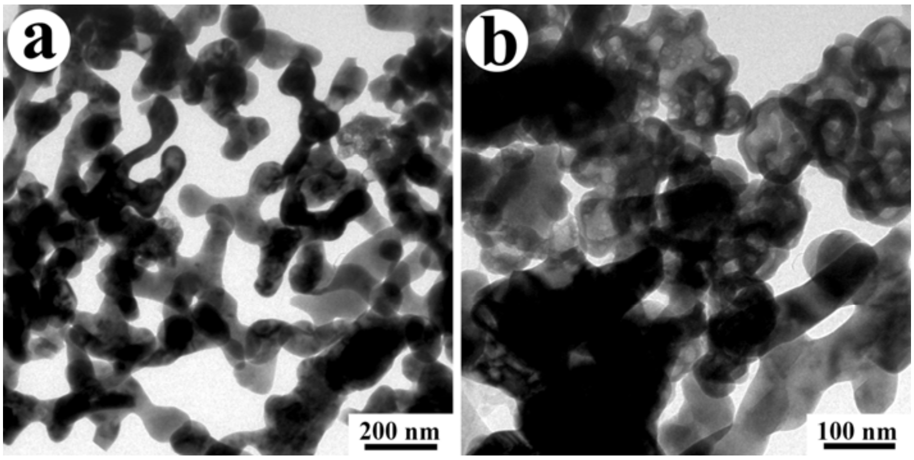

Figure S2. TEM images of the $EuCrO_3$ sample after annealing at 1200 ^oC in N_2 atmosphere.

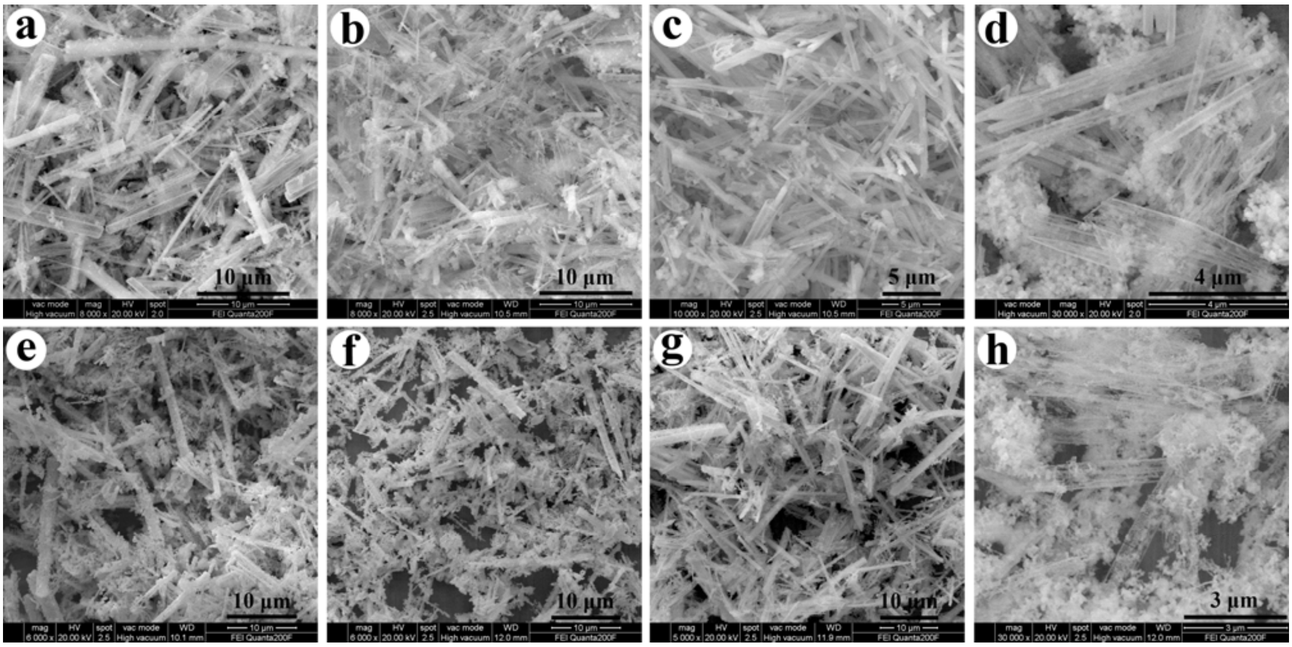

Figure S3. SEM images of the as-synthesized samples for (a) $LaCrO_3$, (b) $PrCrO_3$, (c) $NdCrO_3$ and (d) $SmCrO_3$ before annealing, and the corresponding 800 °C annealing samples for (e) $LaCrO_3$, (f) $PrCrO_3$, (g) $NdCrO_3$ and (h) $SmCrO_3$, respectively. Inset in S3e gives a close-up TEM image at high magnification of the annealing $LaCrO_3$ sample.

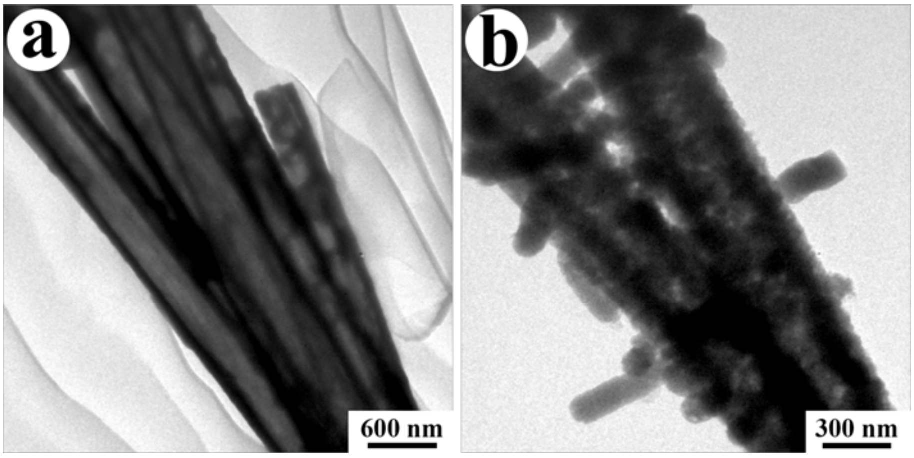

Figure S4. TEM images of the as-prepared $NdCrO_3$ samples (a) before and (b) after annealing.

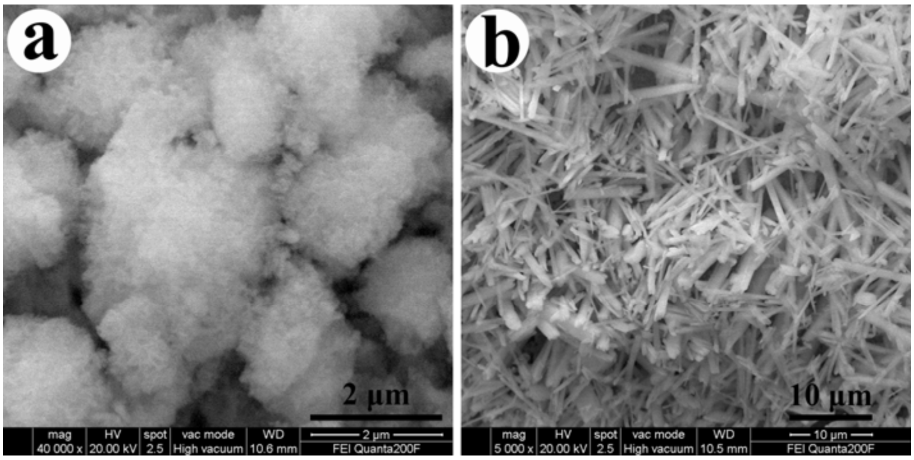

Figure S5. SEM images of the representative (a) $KEu(CrO_4)_2$ and (b) $KNd(CrO_4)_2$ precursors synthesized at room temperature by the direct precipitation between $Eu(NO_3)_3$/$Nd(NO_3)_3$ and K_2CrO_4 aqueous solution.

Table S1. Summary of the magnetic data based on the temperature dependence of the magnetization for all the as-prepared rare-earth orthochromites samples via a general solvothermal *in-situ* reduction route

$RCrO_3$	T_{N1} (K)	$\|\Theta\|$ (K)	C	Experimental μ_{eff} (μ_B) [a]	Theoretical μ_{eff} (μ_B) [b]	$\mu_{R^{3+}}$ (μ_B) [c]	$\mu_{Cr^{3+}}$ (μ_B) [d]
$LaCrO_3$	288	947	3.11	5.00	3.87	0	3.87
$PrCrO_3$	239	316	5.99	6.95	5.27	3.58	3.87
$NdCrO_3$	224	324	4.68	6.14	5.30	3.62	3.87
$SmCrO_3$	192	502	3.89	5.60	3.96	0.84	3.87
$EuCrO_3$	181	1139	22.46	13.46	3.87	0	3.87
$GdCrO_3$	167	37	8.16	8.11	8.83	7.94	3.87
$DyCrO_3$	145	30	14.19	10.70	11.31	10.63	3.87
$HoCrO_3$	140	25	14.10	10.67	11.28	10.60	3.87
$YCrO_3$	140	327	2.35	4.35	3.87	0	3.87
$ErCrO_3$	134	106	20.83	12.96	10.34	9.59	3.87
$TmCrO_3$	124	45	8.06	8.06	8.50	7.57	3.87
$YbCrO_3$	117	145	4.67	6.14	5.97	4.54	3.87
$LuCrO_3$	110	369	3.00	4.92	3.87	0	3.87

[a]The effective magnetic moment (μ_{eff}) in units of the Bohr magneton (μ_B) is evaluated using the formula: $\mu_{eff} = (3k_BC/N_A)^{1/2} = 2.84\cdot C^{1/2}$, where k_B is the Boltzmann constant, C is the Curie constant and N_A is Avogadro's number. [b]The theoretical value of μ_{eff} is obtained by $[(\mu_{R^{3+}})^2 + (\mu_{Cr^{3+}})^2]^{1/2}$. [c]$\mu_{R^{3+}}$ can be calculated by $g[J(J+1)]^{1/2}$. [d]$\mu_{Cr^{3+}}$ can be calculated by $2[S(S+1)]^{1/2}$, where $S = 3/2$.