

Supporting Information

Bottom-up Synthesis of 2D Layered High-Entropy Transition Metal Hydroxides

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Table S1 Solubility product constants (K_{sp} at 25 °C).

Metal species	K _{sp}
Cr(OH) ₃	6.3e-31
Mn(OH) ₂	3e-13
Fe(OH) ₃	1.1e-36
Co(OH) ₂	5.9e-15
Ni(OH) ₂	1.5e-16
Zn(OH) ₂	3e-17

Table S2. pH of the corresponding supernatant after hydrothermal treatment under EG-K/N. Interlayer distance for HEH-2#~7# EG-K/N as synthesized powders.

Samples	pH	Interlayer distance (nm)
HEH-2# EG-K/N	11.8±0.3	0.985
HEH-3# EG-K/N	11.8±0.3	0.987
HEH-4# EG-K/N	11.8±0.3	0.982
HEH-5# EG-K/N	11.9±0.3	0.863
HEH-6# EG-K/N	11.7±0.3	0.985
HEH-7# EG-K/N	11.8±0.3	0.976

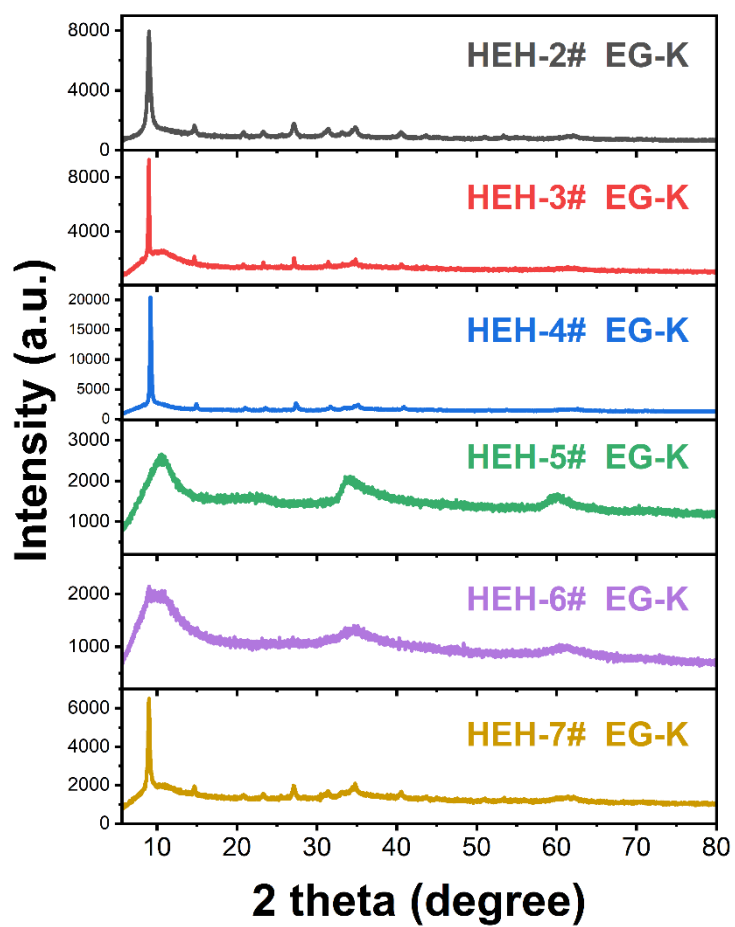


Figure S1 XRD patterns of the HEH-2#~7# EG-K as synthesized powders after hydrothermal treatment at 200 °C for 2 h.

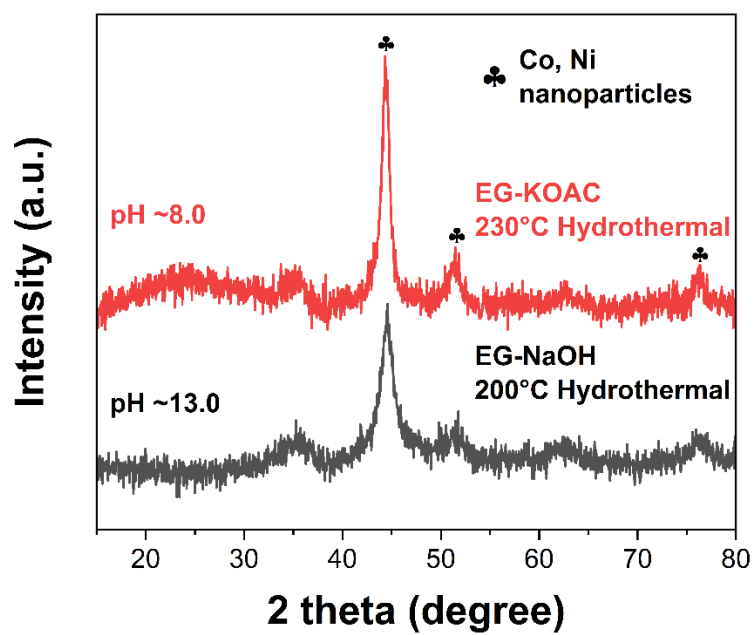


Figure S2. XRD patterns of HEH-1# as synthesized powders using EG-NaOH 200 °C hydrothermal treatment and EG-KOAC 230 °C hydrothermal treatment.

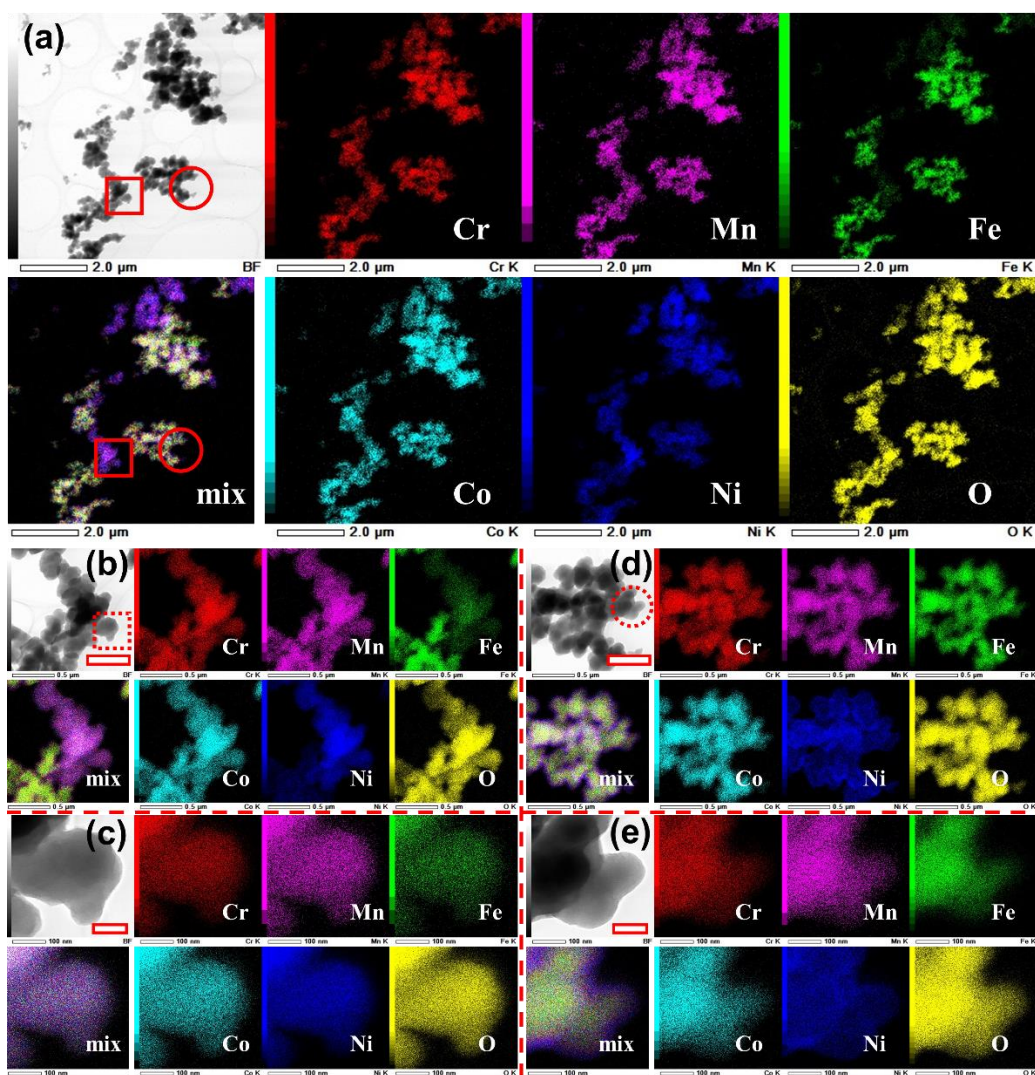


Figure S3 Elemental maps of the HEH-1# EG-K as synthesized powders on various scales. (b) and (d) show the elemental maps for selected areas in (a) as marked by solid square and circle, respectively. (c) and (e) show the elemental maps for selected areas in (b) and (d) as marked by dashed square and circle, respectively. Scale bars in (b) and (d) are 0.5 μm. Scale bar in (c) and (e) are 100 nm. Note: mix figure shows the overlapping Cr-, Fe- and Ni-signals.

Cr-, Fe- and Ni-signals.

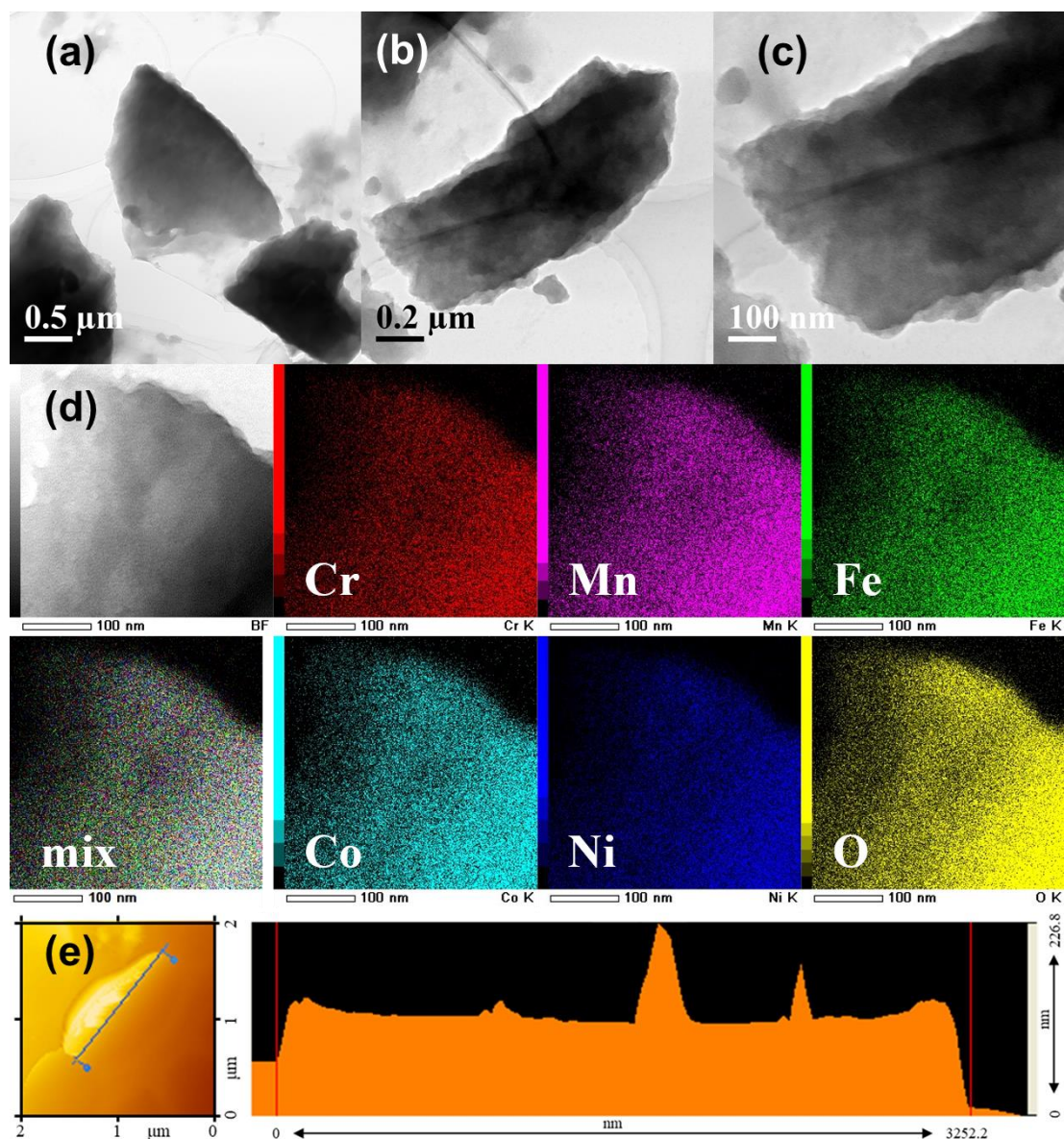


Figure S4 (a)~(c) TEM images with different magnification and (d) Elemental maps of the HEH-1# EG-K/N as synthesized powders. Note: mix figure shows the overlapping Cr-, Fe- and Ni-signals. (e) AFM image of the sample.

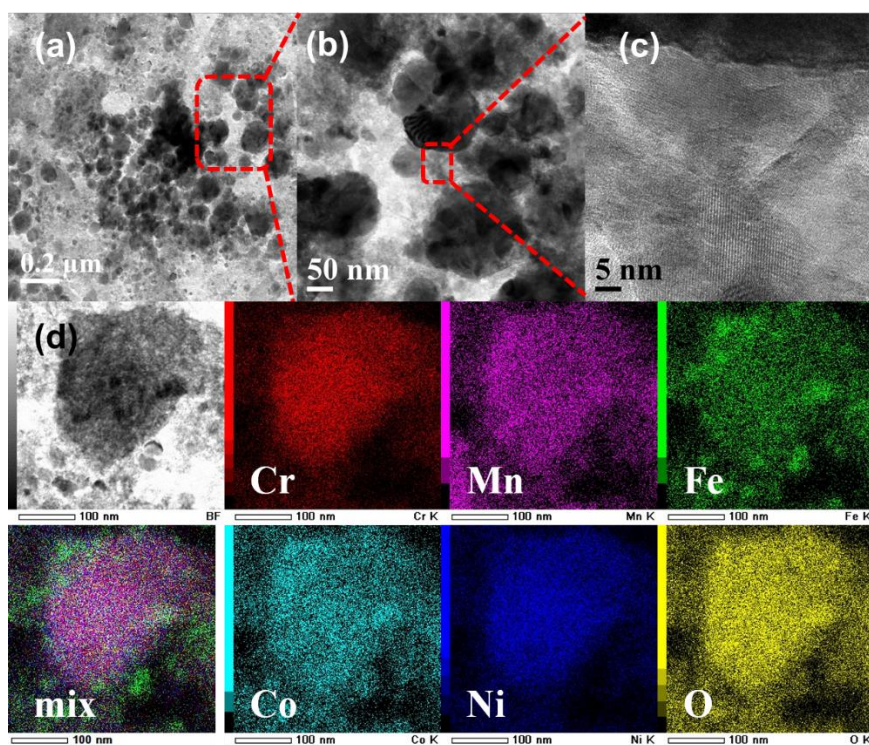


Figure S5 TEM images with different magnification and Elemental maps of the HEH-1# H₂O-K/N as synthesized powders. Note: mix figure shows the overlapping Cr-, Fe- and Ni-signals.

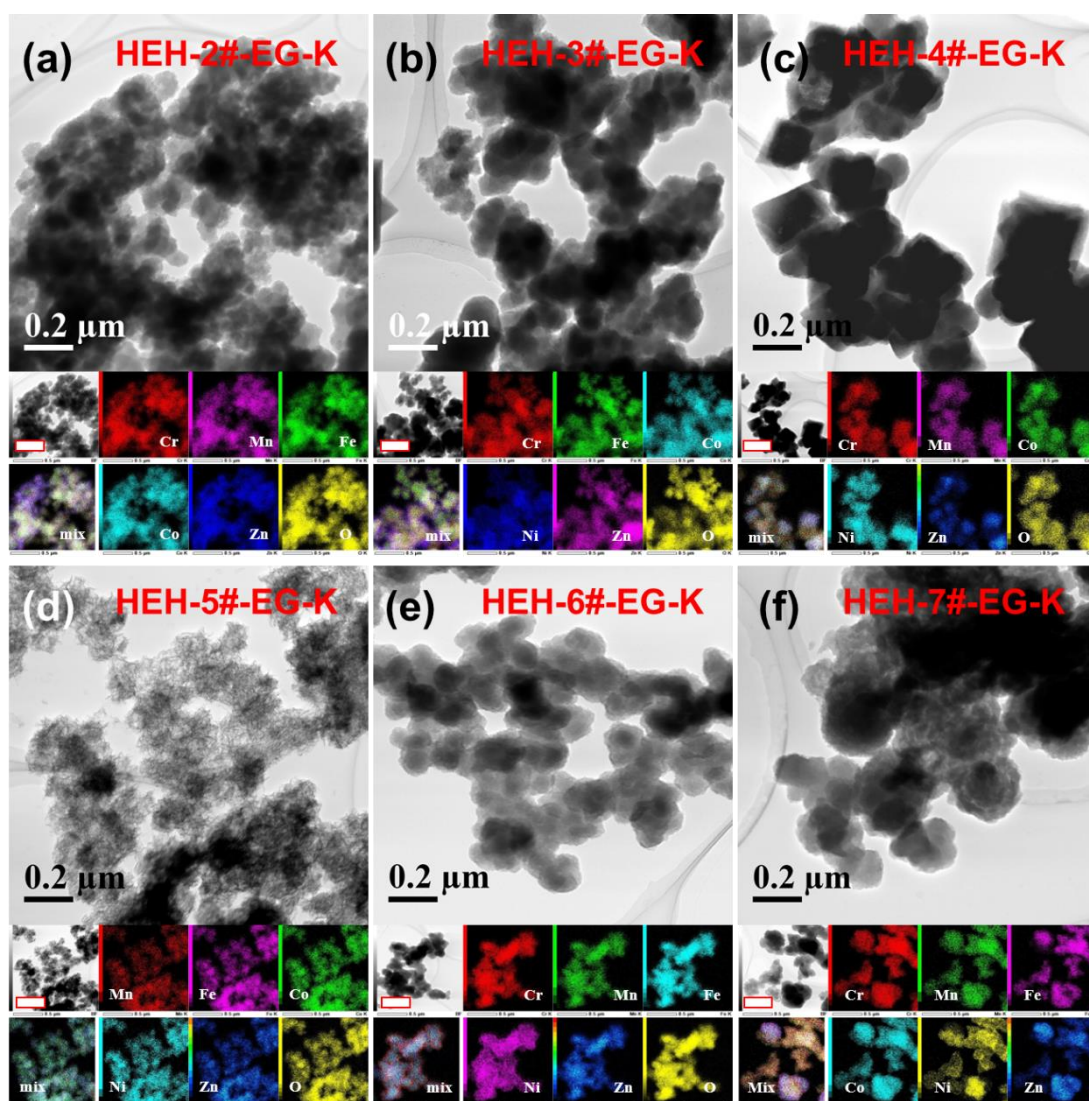


Figure S6 TEM images and elemental maps for the HEH-2#~7# EG-K as synthesized powders. Scale bars in the elemental maps are 0.5 μm .

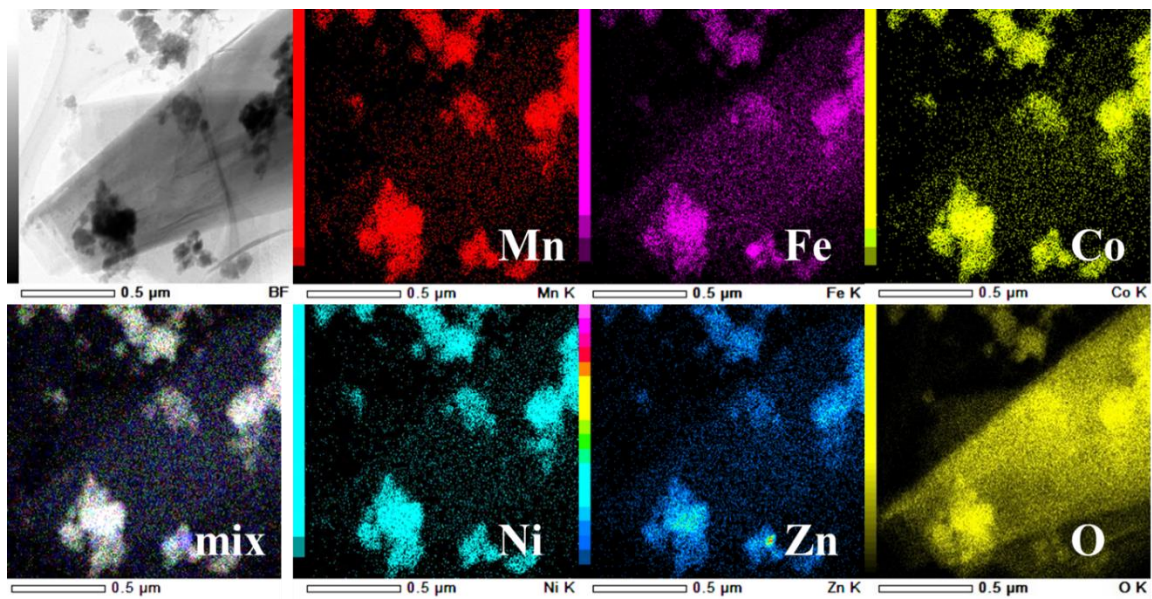


Figure S7 EDS mapping for HEH-5# EG-K/N as synthesized powders showing typical 2D layered structures with uniform elemental distribution.

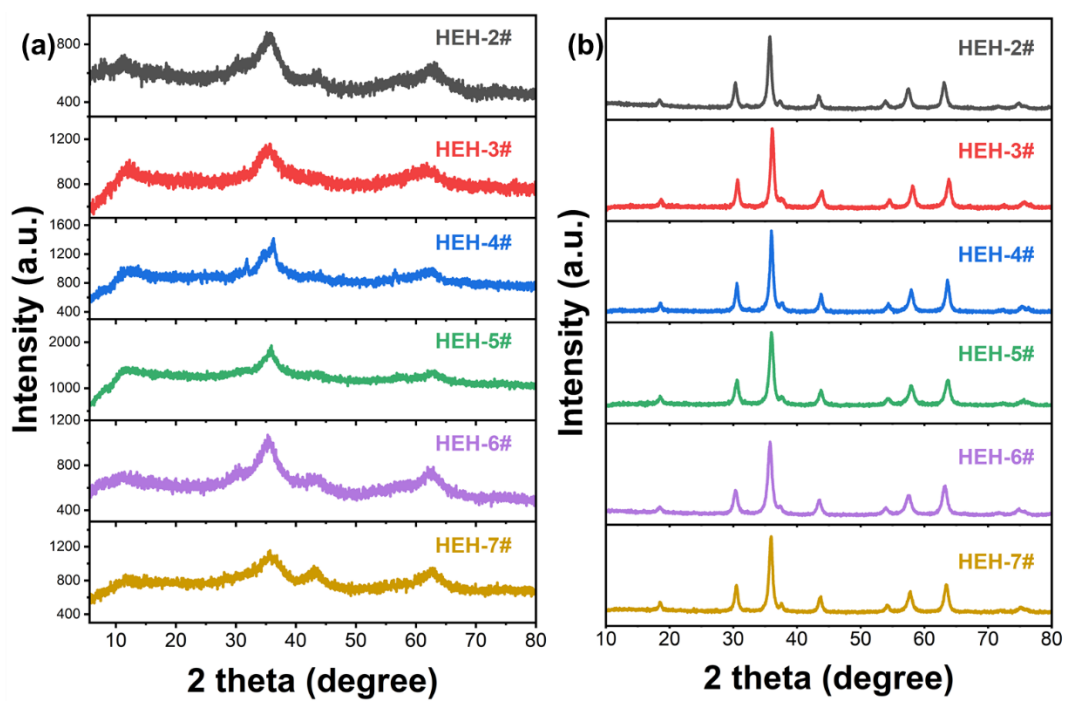


Figure S8 XRD patterns of the HEH-2#~7# EG-K/N powders after annealed at (a) 200 and (b) 600 °C.

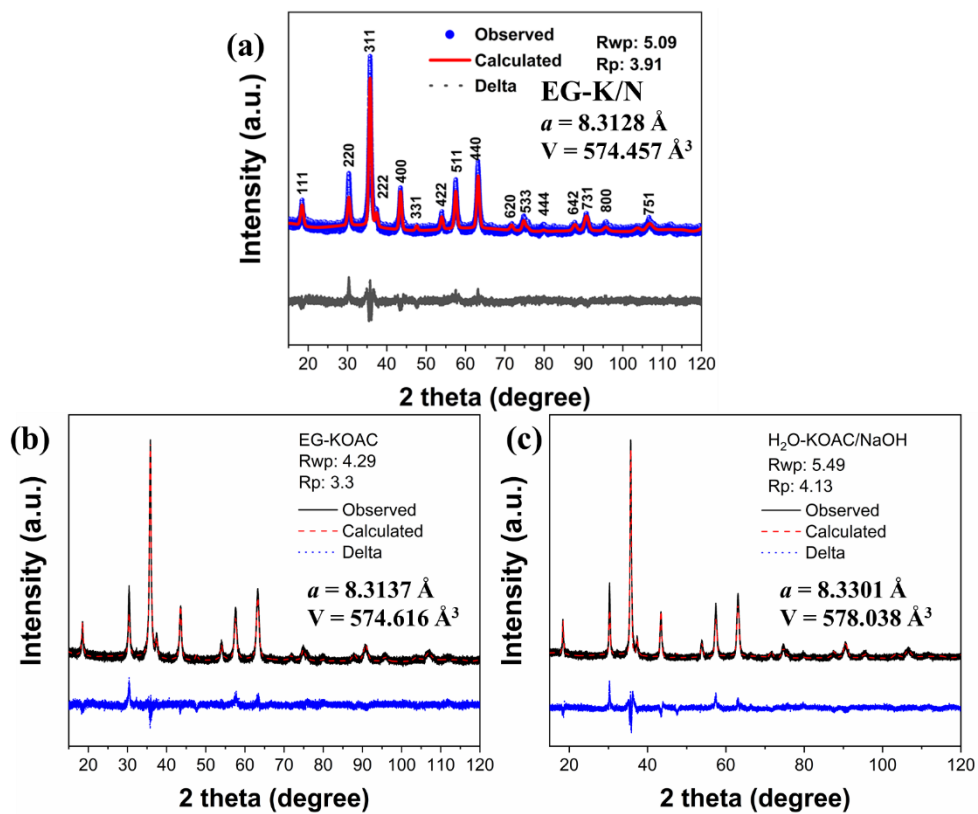


Figure S9 XRD refinement of the HEH-1# (a) EG-K/N, (b)EG-K, and (c) H₂O-K/N samples after 600 °C annealing.

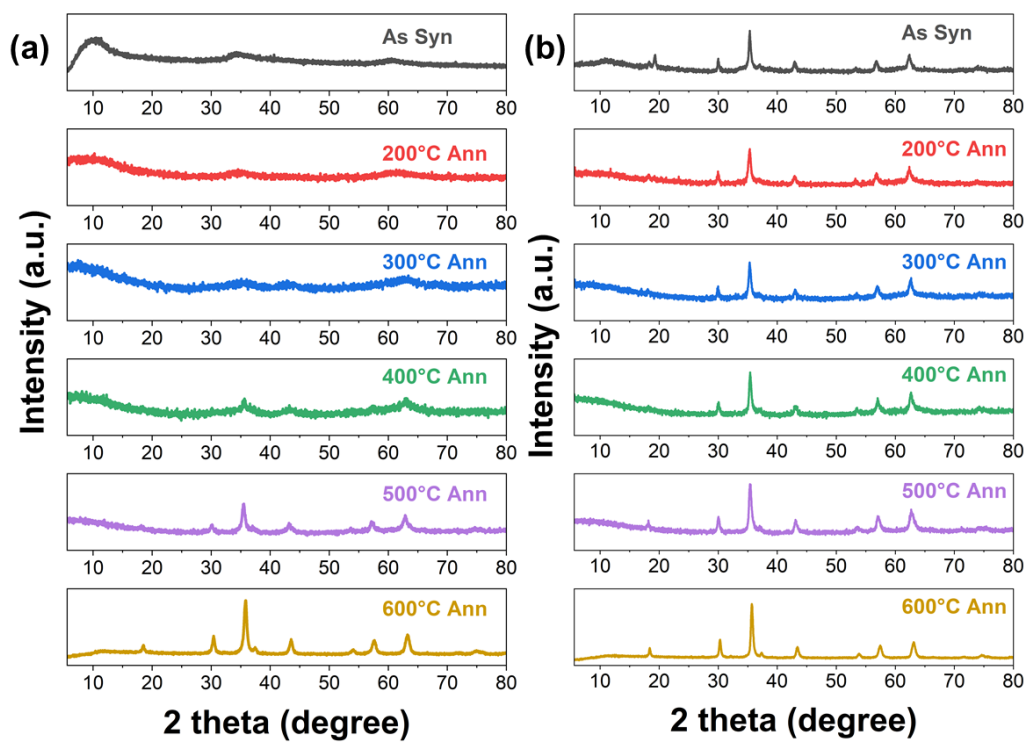


Figure S10 XRD patterns of the HEH-1# (a) EG-K and (b) H₂O-K/N after annealing at different temperatures.

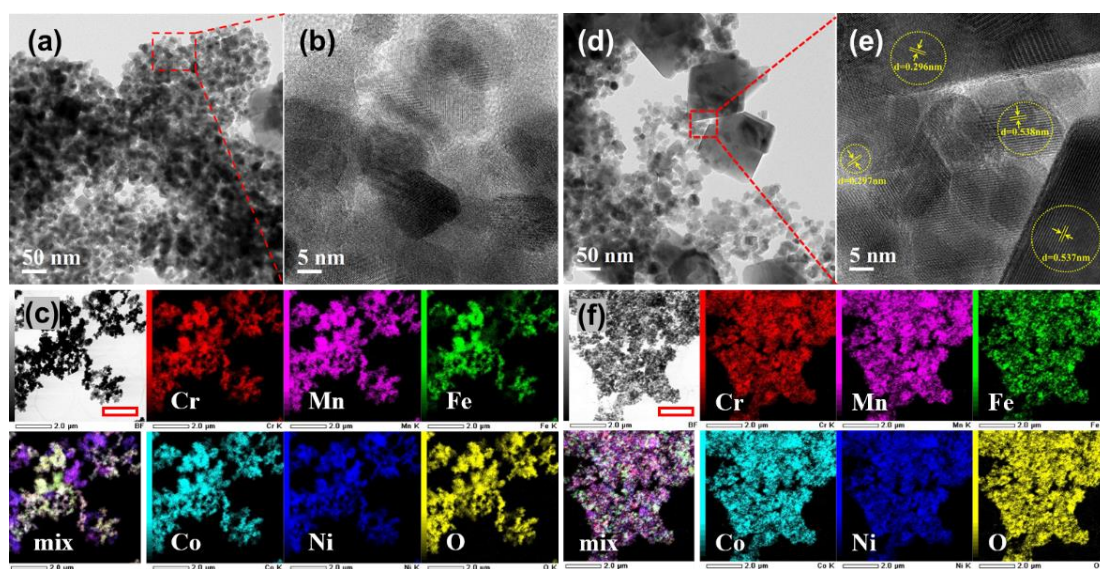


Figure S11 TEM images and elemental maps of the HEH-1# (a~c) EG-K and (d~f) H₂O-K/N powders after annealed at 600°C. Scale bars in (c) and (d) are 2 μm. Note:

mix figure shows the overlapping Cr-, Fe- and Ni-signals.

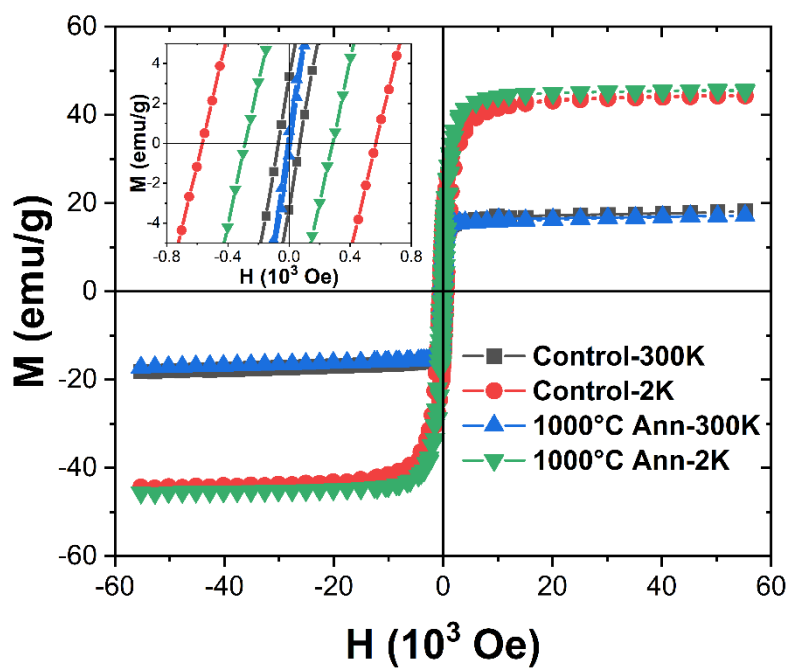


Figure S12 M-H curves for HEH-1# EG-K/N 1000°C-annealed powders and control powders prepared by solid state reactions.

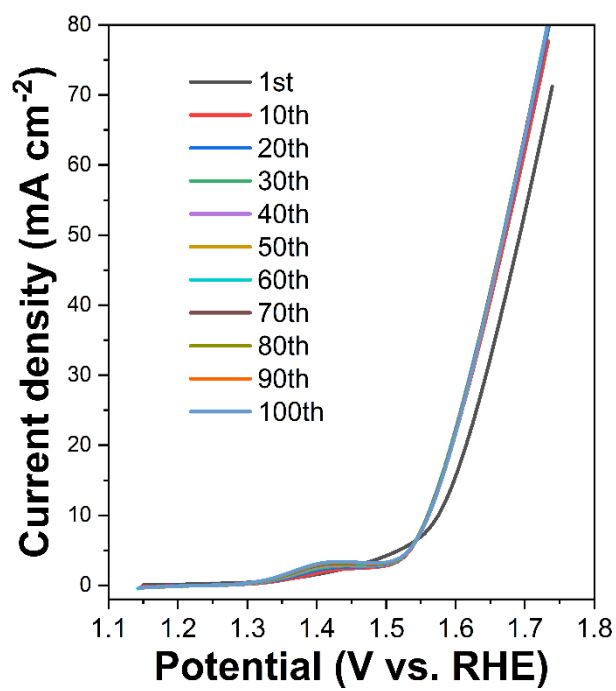


Figure S13. LSV curves of the HEH-1# as synthesized sample during 100 cyclic voltammetry cycles.