Supplemental Information

Unique nanosheet-nanowire structured CoMnFe layered <mark>triple</mark> hydroxide arrays as self-supporting electrodes for high-efficiency oxygen evolution reaction

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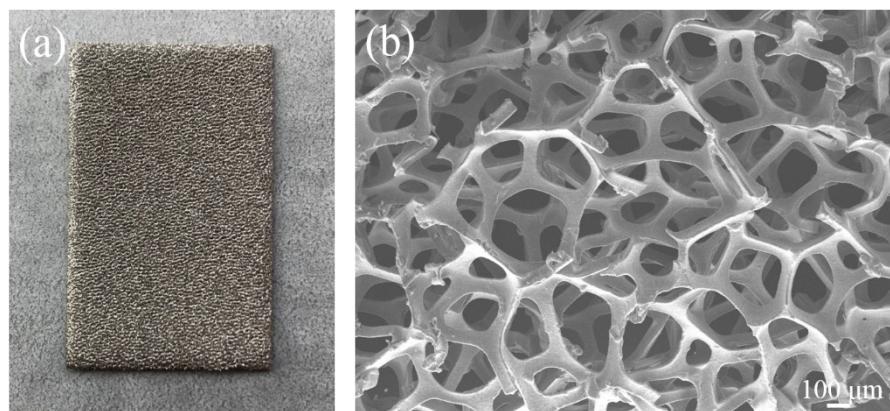
Figure S1. Photograph and SEM image of Ni foam.

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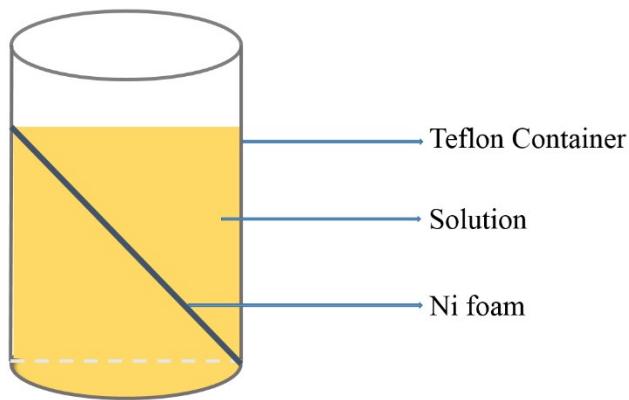
Figure S2. The illustration of the Teflon autoclave apparatus to synthesize materials on Ni foam substrate.
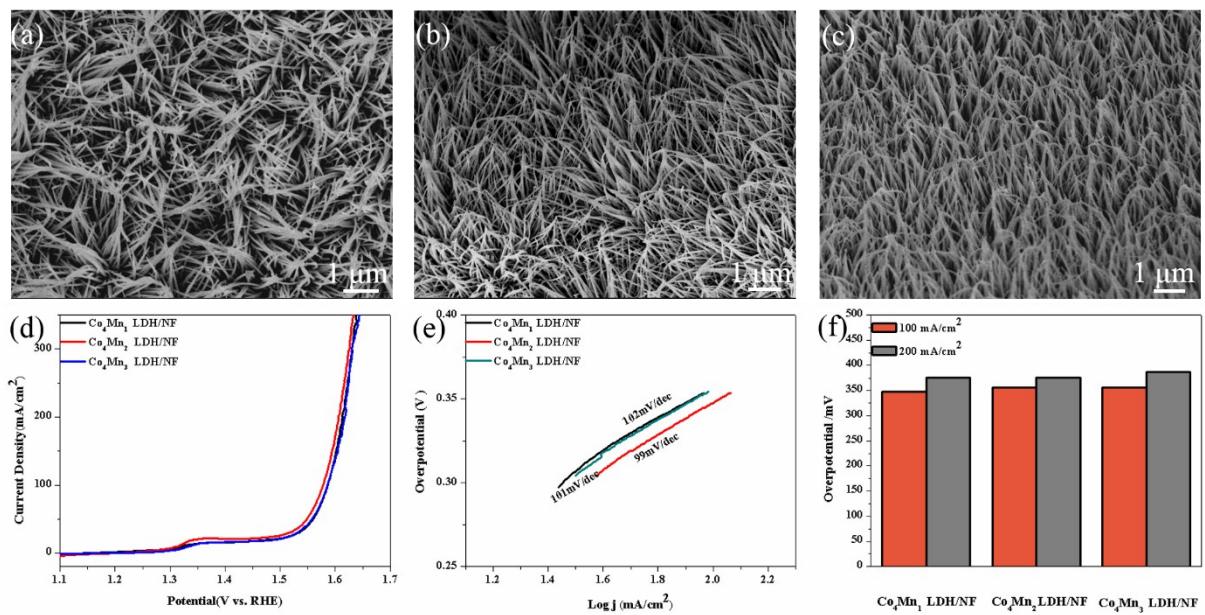
Figure S3. SEM images of (a) Co_4Mn_1 LDH/NF, (b) Co_4Mn_2 LDH/NF and (c) Co_4Mn_3 LDH/NF samples; (c) LSV curves, (e) Tafel plots and (f) corresponding contrast of Co_4Mn_1 LDH/NF, Co_4Mn_2 LDH/NF and Co_4Mn_3 LDH/NF.
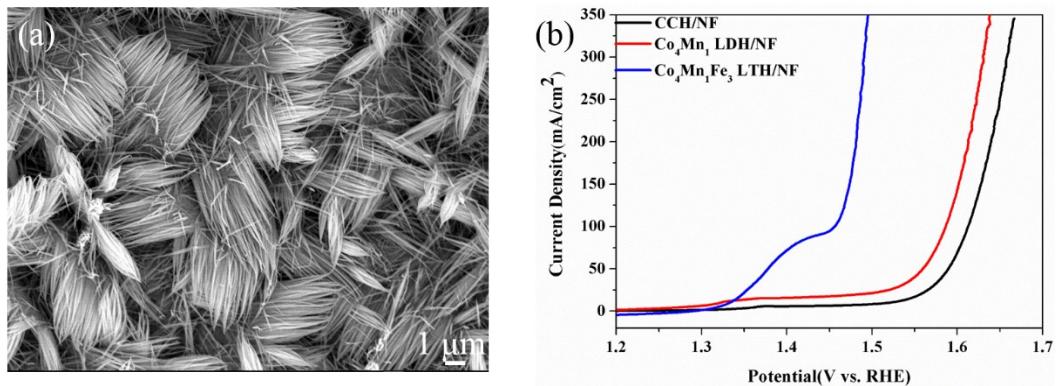
Figure S4. (a)SEM image of CCH/NF; (b) LSV curves of CCH/NF, Co_4Mn_1 LDH/NF and $Co_4Mn_1Fe_3$ LTH/NF.
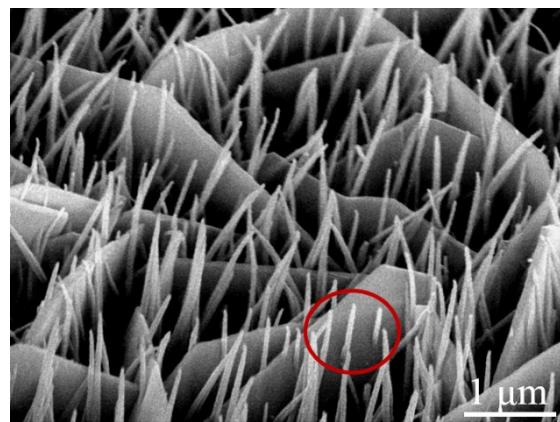
Figure S5.SEM image of $Co_4Mn_1Fe_3$ LTH/NF.

Element	Weight percentage	Atomic percentage
C K	7.50	14.50
O K	45.92	66.64
Mn K	3.54	1.50
Fe K	18.24	7.58
Co K	24.80	9.77
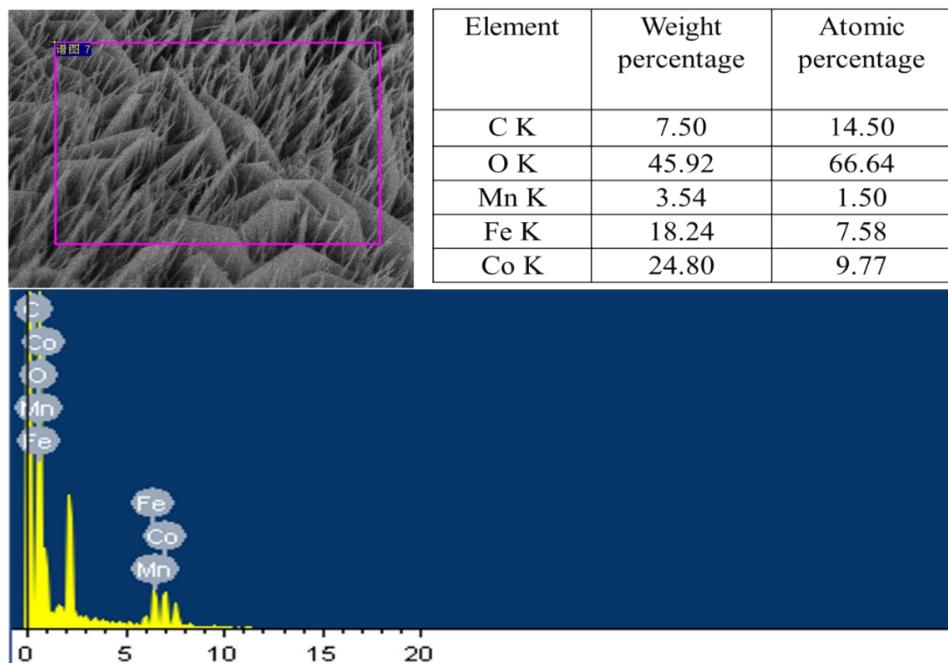
Figure S6. The EDS elemental analysis of $Co_4Mn_1Fe_3$ LTH/NF.
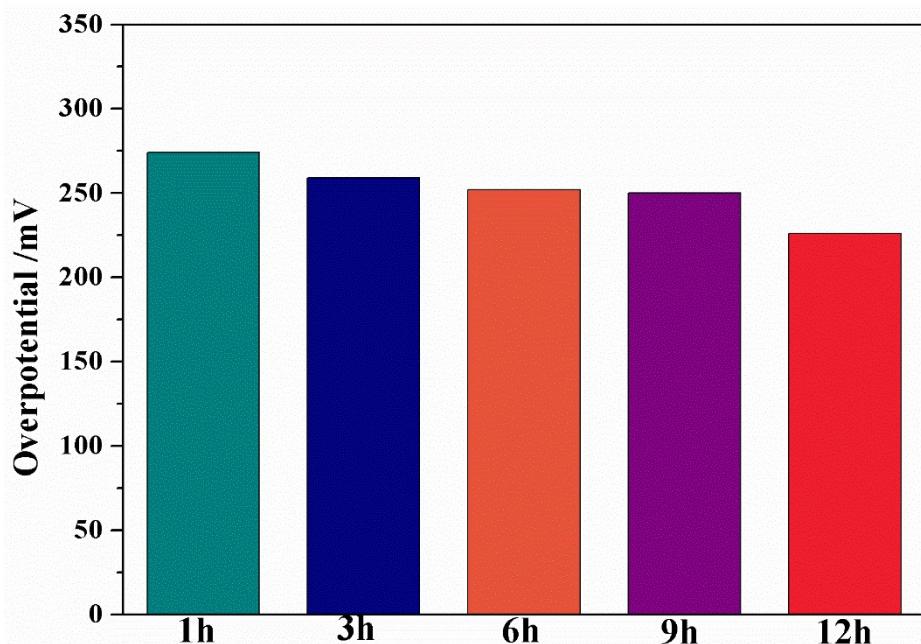

Figure S7. overpotentials of $Co_4Mn_1Fe_3$ LTH/NF with different hydrothermal

treatment time at J= 100 mA cm^{-2}.
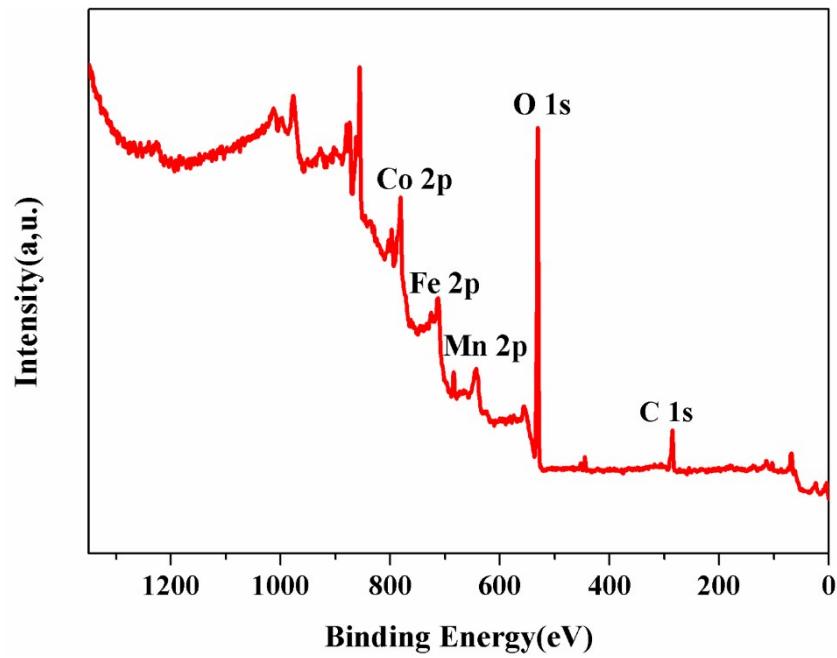
Figure S8. XPS survey spectra of $Co_4Mn_1Fe_3$ LTH/NF.
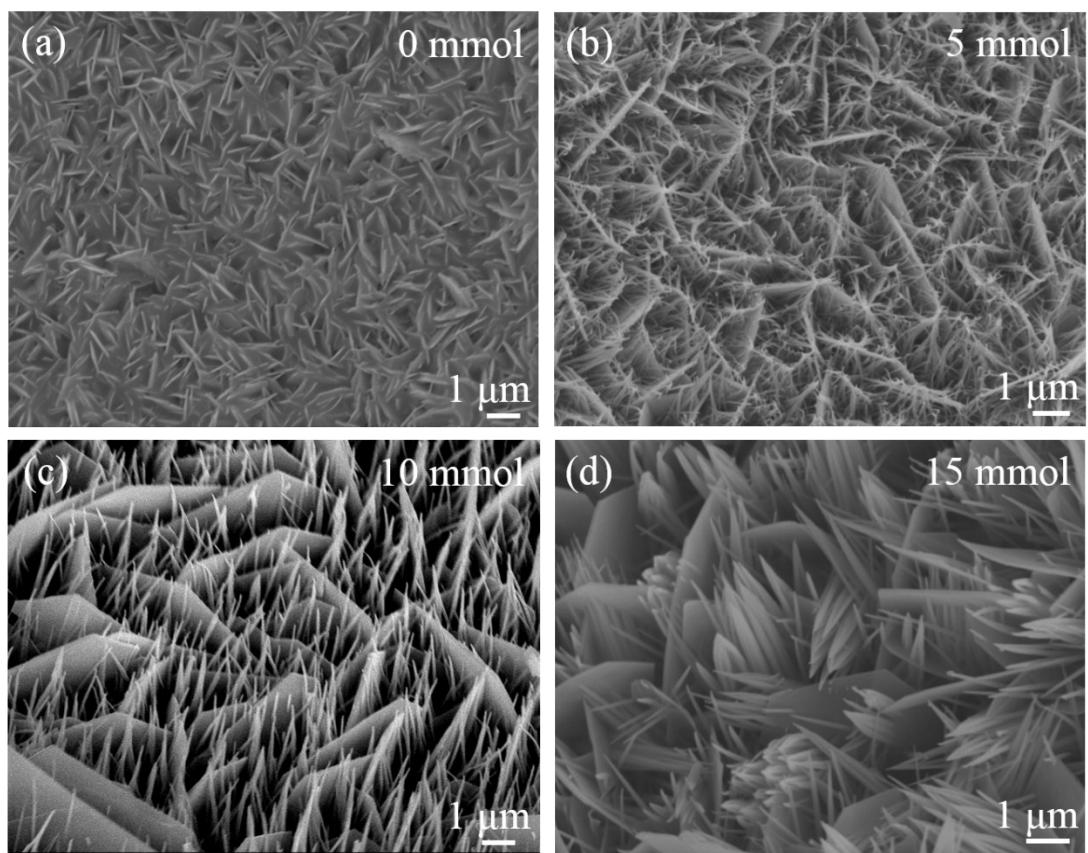
Figure S9. SEM images of $Co_4Mn_1Fe_3$ LTH/NF containing different NH_4F amounts.
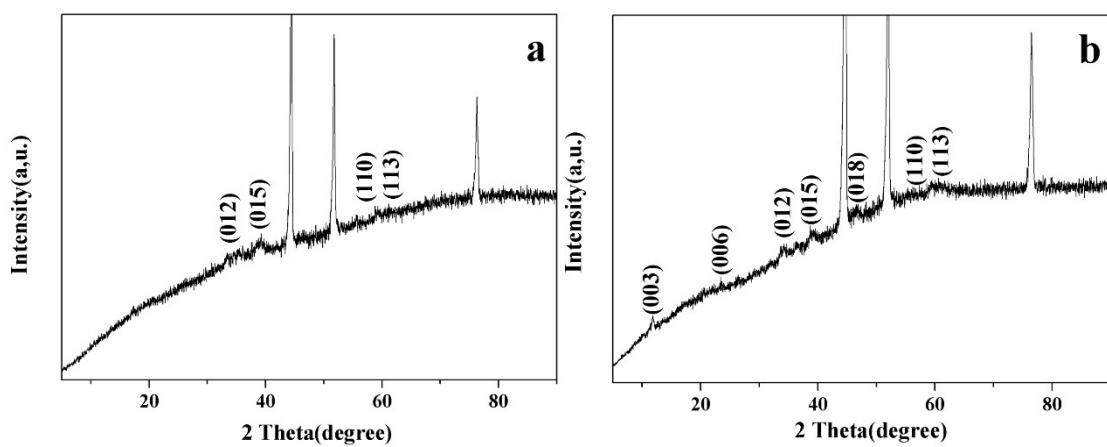
Figure S10. XRD data of (a) Co_4Mn_1 LDH/NF and (b) $Co_4Mn_1Fe_1$ LTH/NF.
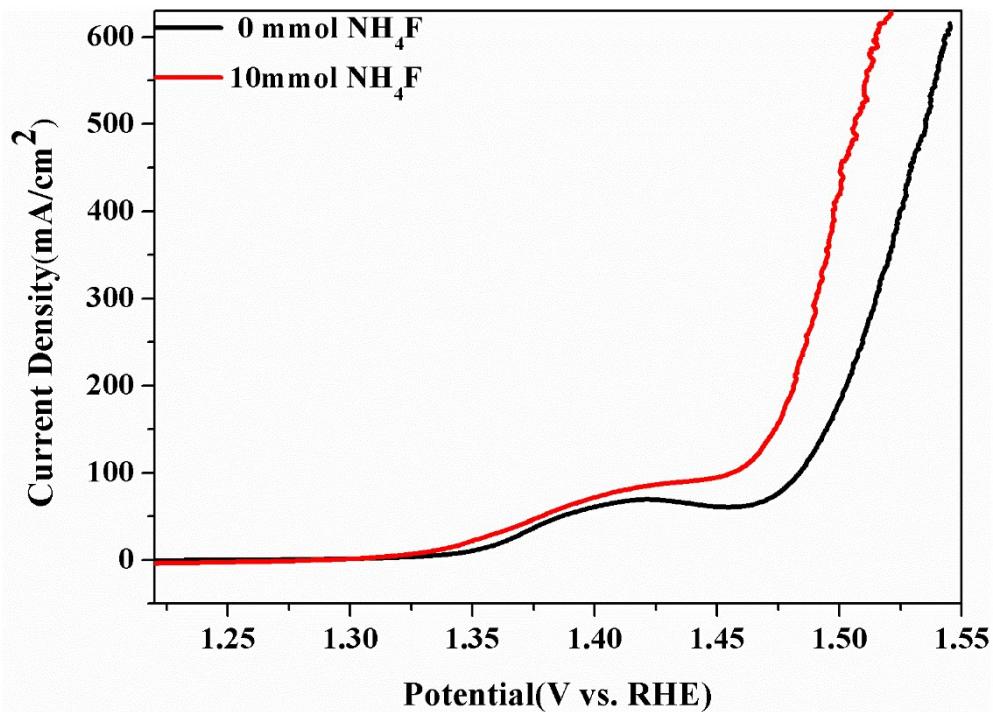
Figure S11. LSV curves of $Co_4Mn_1Fe_3$ LTH/NF containing 10 mmol NH_4F or not.

Table S1. Comparison of catalytic performance of $Co_4Mn_1Fe_3$ LTH/NF to recently

reported high performance LDH-based OER electrocatalysts

LDH-based electrocatalysts	Electrolyte	Current density [mA cm^{-2}]	Overpotential for OER [mV]	Tafel slope [mV decade^{-1}]	reference
NiFe LDHs	1M KOH	10	≈350	64	[S1]
NiV LDHs	1M KOH	10	≈310	50	[S1]
CoMn LDHs	1M KOH	10	324	43	[S2]
NiFe-LDH HMS	1M KOH	10	239	53	[S3]
Cu@NiFe LDHs	1M KOH	10	199	27.8	[S4]
NiFe-LDH/NiCo$_2$O$_4$/NF	1M KOH	50	350	53	[S5]
NiCo$_2$S$_4$@NiFe-LDH/NF	1M KOH	60	201	46.3	[S6]
FeOOH/NiFe-LDH/NF	1M KOH	10	208	-	[S7]
NiFe:Pi/NiFe-LDH/CFP	1M KOH	10	290	38	[S8]

CoSe/NiFe-LDH/EG	1M KOH	150	270	57	[S9]
NiFeCo LDHs	1M KOH	10	220	42	[S10]
NiFeMn LDHs	1M KOH	20	289	47	[S11]
NiCoFe LTHs/CFC	1M KOH	10	239	32	[S12]
MoO_4^-/NiFe LDHs	1M KOH	10	280	40	[S13]
PO_4^{3-}/NiFe LDH	1M KOH	10	≈260	≈42.1	[S14]
HPO_3^{2-}/NiFe LDH	1M KOH	10	≈270	≈40.6	[S14]
$H_2PO_2^{3-}$/NiFe LDH	1M KOH	10	≈240	≈37.7	[S14]
CO_3^{2-}/NiFe LDH	1M KOH	10	≈330	≈44.3	[S14]
Exfoliated NiFe LDHs	1M KOH	10	300	40	[S15]
Exfoliated NiCo LDH	1M KOH	10	330	41	[S15]
Exfoliated CoCo LDH	1M KOH	10	350	45	[S15]
Exfoliated NiCo LDH/CP	1M KOH	10	300	40	[S16]
H_2O-plasma exfoliated CoFe LDHs	1M KOH	10	290	36	[S17]
Ar-CoFe LDHs	1M KOH	10	266	37.6	[S18]
Defect-rich ultrathin CoFe LDHs	1M KOH	10	300	40	[S19]
NiFe LDHs/NF	1M NaOH	10	240	-	[S20]
Ni_5Fe LDH@NF	1M KOH	10	210	59	[S21]
NiFe LDHs/CNTs	1M KOH	5	≈250	31	[S22]
CNF/Fe-doped Ni LDH	1M KOH	10	220	34	[S23]
NiFe-rGO LDH hybrid	1M KOH	10	206	39	[S24]
nNiFe LDH/NGF	0.1M KOH	10	337	45	[S25]
CoAl LDH/3DGN	1M KOH	10	252	36	[S26]
NiFe LDH-NS@DG hybrid	1M KOH	10	210	52	[S27]
CQD/NiFe LDH hybrid	1M KOH	10	≈235	30	[S28]
$Co_4Mn_1Fe_3$ LDH/NF	1M KOH	10	200	55	This work

Table S2. The ICP results of metal contents and atomic ratios of Co: Mn: Fe in all the

S8

Sample	Content (%) (Co, Mn, Fe)	Atomic ratio (Co: Mn: Fe)
Co_4Mn_1 LDH/NF	11.87%, 2.58%, 0.00%	0.81: 0.19: 0
$Co_4Mn_1Fe_1$ LTH/NF	7.42%, 1.15%, 1.68%	0.71: 0.12: 0.17
$Co_4Mn_1Fe_2$ LTH/NF	7.62%, 1.35%, 2.15%	0.67: 0.13: 0.20
$Co_4Mn_1Fe_3$ LTH/NF	7.01%, 0.77%, 3.67%	0.60: 0.07: 0.33
$Co_4Mn_1Fe_4$ LTH/NF	8.75%, 1.45%, 9.60%	0.43: 0.07: 0.50

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