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Supplementary materials for

Multifunctional amorphous FeCoNiTi$_x$Si high-entropy alloys with excellent electromagnetic-wave absorption performances

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Supplementary Table and Figures

Table S1 Melting point, Crystal structure, and atomic radius.

Element	**Fe**	**Co**	**Ni**	**Ti**	**Si**
Melting point (°C)	1538	1495	1455	1668	1414
Crystal structure	BCC	HCP	FCC	HCP	FCC
Atomic radius (pm)	126	125	124	147	111

$$\Omega = \frac{T\Delta S_{mix}}{|\Delta H_{mix}|} \quad \text{(S1)}$$

$$\delta = \sqrt{\sum_{i=1}^{n} c_i\left(1 - r_i / \bar{r}\right)^2} \quad \text{(S2)}$$

$$VEC = \sum_{i}^{n} c_i(VEC)_i \quad \text{(S3)}$$

Where c_i is the mole fraction of element i. $\bar{r}$ and T_m are the average atomic radius and the melting point of the alloy, respectively. The ΔH_{ij}^{mix} represents the mixing enthalpy of a binary system of equimolar composition in the liquid phase.

Table S2 Grain sizes, internal stress, the crystallinity and lattice constant of samples

Samples	**#T001**	**#T010**	**#T030**
Grain size (nm)	10.2	12	12.8
Intrinsic strain（ε*10^{-3}）	0.892	0.768	0.718
Crystallinity(%)-BCC	57.15	59.95	64.51
Lattice Constant(A)-BCC	4.0508	4.0509	4.3609

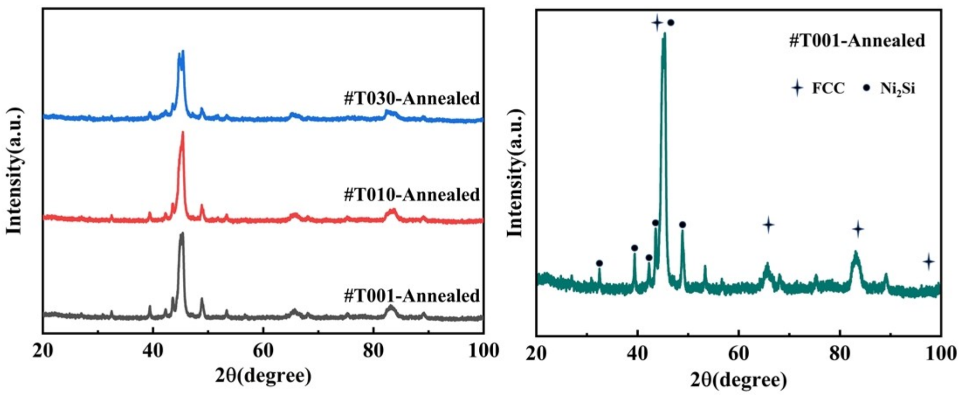

Fig. S1 XRD diagram of #T001, #T010, and #T030 after annealing.

Table S3 Binary mixing enthalpies for each atom pair in Fe–Co–Ni–Ti–Si alloys.

ΔH_{ij}^{mix} **(kJ×mol^{-1})**				
Fe	-1	-2	-17	-35
/	Co	0	-28	-38
/	/	Ni	-35	-40
/	/	/	Ti	-45
/	/	/	/	Si

Table S4 Chemical Compositions of samples #T001, #T010, #T030, #T100 and #T200.

Samples	**Atomic percent(%)**				
	Fe	**Co**	**Ni**	**Ti**	**Si**
#T001	27.49	27.77	25.92	0.34	18.48
#T010	26.18	26.89	24.58	2.5	19.85
#T030	26.08	23.83	22.50	8.86	18.72
#T100	23.19	21.64	20.27	19.76	15.14
#T200	33.41	17.27	17.17	33.41	12.91

Table S5 Electrochemical parameters of equivalent circuit under different stray current densities.

Samples	**R_s** (Ω cm^2)	**CPE_1-T** μΩ^{-1} cm^2 s^p)	**CPE_1-P** (F/cm)	**CPE_2-T** (μΩ^{-1} cm^2 s^p)	**CPE_2-P** (F/cm)	**R_{ct}1**	**R_{ct}2**
#T001	4.088	0.00034277	0.67895	0.00017381	0.92338	127.6	33639
#T010	3.308	0.00026379	0.67015	0.00016832	0.91616	109.1	129390
#T030	3.584	0.00030884	0.67077	0.00018296	0.86741	123.9	694680

#T100	3.768	0.0003933	0.70339	0.00017699	0.88591	63.22	1.202E7
#T200	3.575	0.00024919	0.67073	0.00015231	0.90477	84.9	300370

Rs represents the solution resistance, CPE_1 the double-layer capacitance at the passivation film/material interface, $R_{ct}1$ the electrochemical transfer resistance, CPE_2 the passivation film capacitance, and $R_{ct}2$ the ion transport resistance in the passivation film.

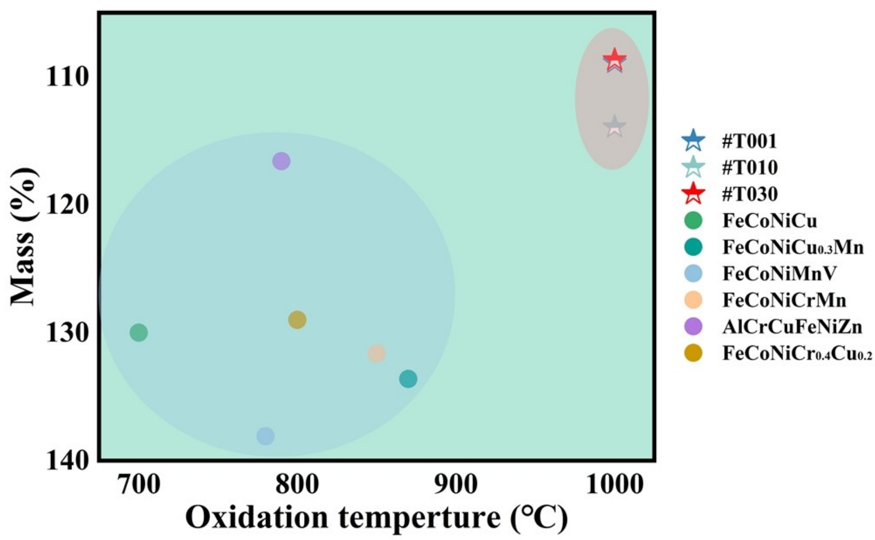

Fig. S2 The comparison of oxidation resistance properties with other related materials.[1-6]

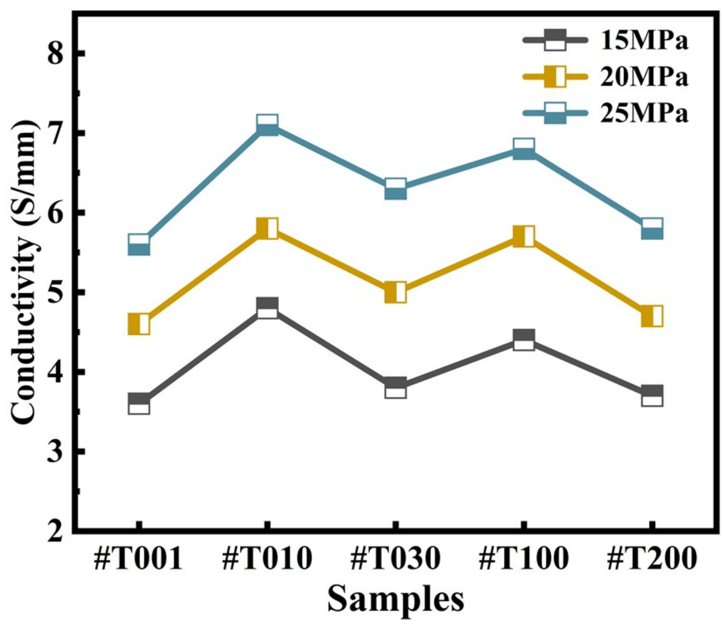

Fig. S3 Conductivity of $FeCoNiTi_xSi$ (x = 0.01, 0.1, 0.3, 1 and 2) HEAs powders under different pressures.

Table S6 The detailed conductivity of $FeCoNiTi_xSi$ (x = 0.01, 0.1, 0.3, 1, and 2) HEAs under different pressures.

Pressure (MPa)	Conductivity (S/mm)				
	#T001	#T010	#T030	#T100	#T200
15	3.6	4.8	3.8	4.4	3.7
20	4.6	5.8	5	5.7	4.7
25	5.6	7.1	6.3	6.8	5.8

Table S7 The detailed data of EMW absorption properties of FeCoNiTixSi (x = 0.01, 0.1, 0.3, 1, and 2) HEAs in the 2–18 GHz range.

Samples	RL_{min} (dB)	Frequency (GHz)	d_{min}	Bandwidth (GHz)	RL<-10 dB	d (mm)
#T001	-68.4	6.14	3.08	5.15	11.67-16.82	1.69
#T010	-28.3	8.96	2.76	3.68	9.86-13.54	2.31
#T030	-30.5	10.80	2.32	4.03	11.48-15.51	1.94
#T100	-63.4	9.12	2.18	3.64	13.80-17.45	1.42
#T200	-21.3	18	4	-	-	-

Table S8 The comparison of comprehensive properties with related materials.

	RL_{min} (dB)	EMB (GHz)	d_m (mm)	Nanohardness (Gpa)	i_{corr} ($\mu A/cm^2$)	Ref.
#T001	-68.4	5.12	1.69	3.97	1.64	This work
#T100	-63.4	3.64	1.42	3.07	1.49	This work
FeSi	-19.3	3.9	3.03	-	-	Ref. 40
FeSiAl	-39.7	0.85	4	-	-	Ref. 36
FeCoNiCrMn	-	-	-	2.35	-	Ref. 43
$FeCoNiCuAlCe_{0.09}$	-	-	-	-	4.01	Ref. 46
FeCrMoNiPBCSi	-60.3	2.3	3.55	-	-	Ref. 16
$FeCoNiMn_{0.5}Al_{0.4}$	-42.9	4.4	3	-	-	Ref. 38
$Fe_{77.6}Si_{12.3}Al_{10.1}$	-22.2	6	2	-	-	Ref. 35
$FeCoNiCuTi_{0.2}$	-47.8	4.76	2.16	-	0.949	Ref. 15
$FeCoNiCuC_{0.04}$	-61.1	5.1	1.72	3.42	5.14	Ref. 41
$FeCoNi(Si_{0.6}Al_{0.2}B_{0.2})$	-44.1	3.8	2	-	-	Ref. 44
$Ti_{21.6}Al_{11.3}Cr_{19.4}Si_{23.5}V_{22.0}O_{2.2}$	-	-	-	-	6.14	Ref. 39
HCNs	-45.7	3.9	3.6	-	-	Ref. 34
Co_4Fe_6	38.7	6.9	2	-	-	Ref. 45
$Mg_{65}Ni_{20}Nd_{15}$	-	-	-	3.4	-	Ref. 42
$FeCoNiMn_{0.5}Al_{0.2}$	-44.4	3.825	3	3.97	-	Ref. 37

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