Electronic supplementary information

Power Generation from n-type $NbCo_{1-x}Ni_xSn$ and p-type $NbFe_{1-x}Mn_xSb$ Ternary Half-Heusler Compounds: From Materials Development to Module Fabrication

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Table S1

Relative densities %, maximum *zT*, and average *zT* for *n*-type $NbCo_{1-x}Ni_xSn$ and *p*-type $NbFe_{1-x}Mn_xSb$ samples.

Sample	Dopant amount	Relative densities %	Maximum *zT*	Average *zT* (323 K to 873 K)
n-type $NbCo_{1-x}Ni_xSn$	$x = 0$	98	0.14 [at 873 K]	0.06
	$x = 0.04$	98	0.23 [at 873 K]	0.10
	$x = 0.10$	98	0.34 [at 873 K]	0.18
	$x = 0.14$	99	0.41 [at 873 K]	0.20
p-type $NbFe_{1-x}Mn_xSb$	$x = 0$	99	0.01 [at 723 K]	0.01
	$x = 0.04$	99	0.14 [at 723 K]	0.11
	$x = 0.10$	99	0.07 [at 773 K]	0.06
	$x = 0.14$	100	0.06 [at 723 K]	0.05

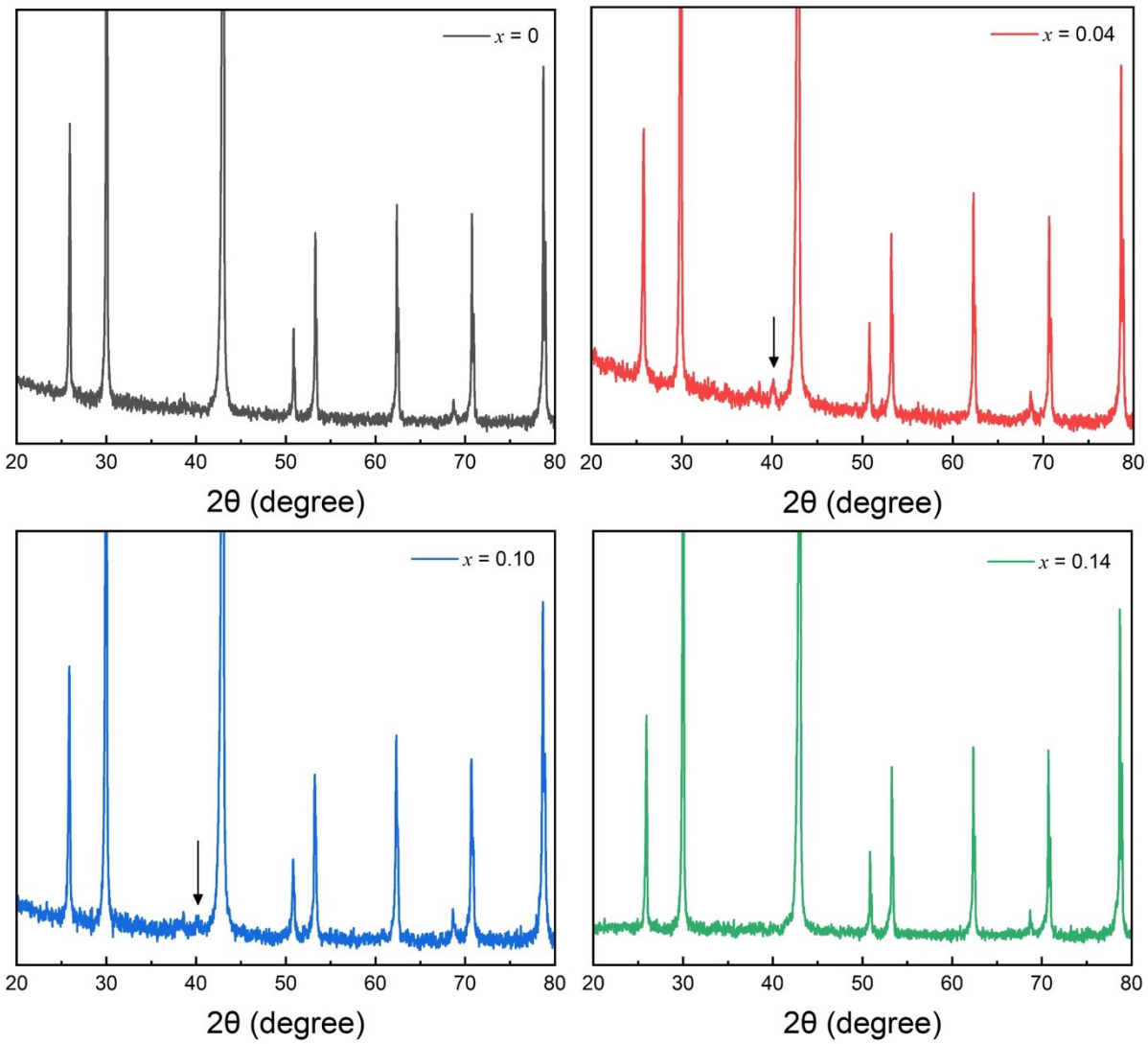

Fig. S1

Zoom-in X-ray diffraction pattern of *n*-type $NbCo_{1-x}Ni_xSn$ measured on the polished surfaces of sintered bulk specimens (**Fig. 1(a)**). The weak secondary phase is indicated by black arrow.

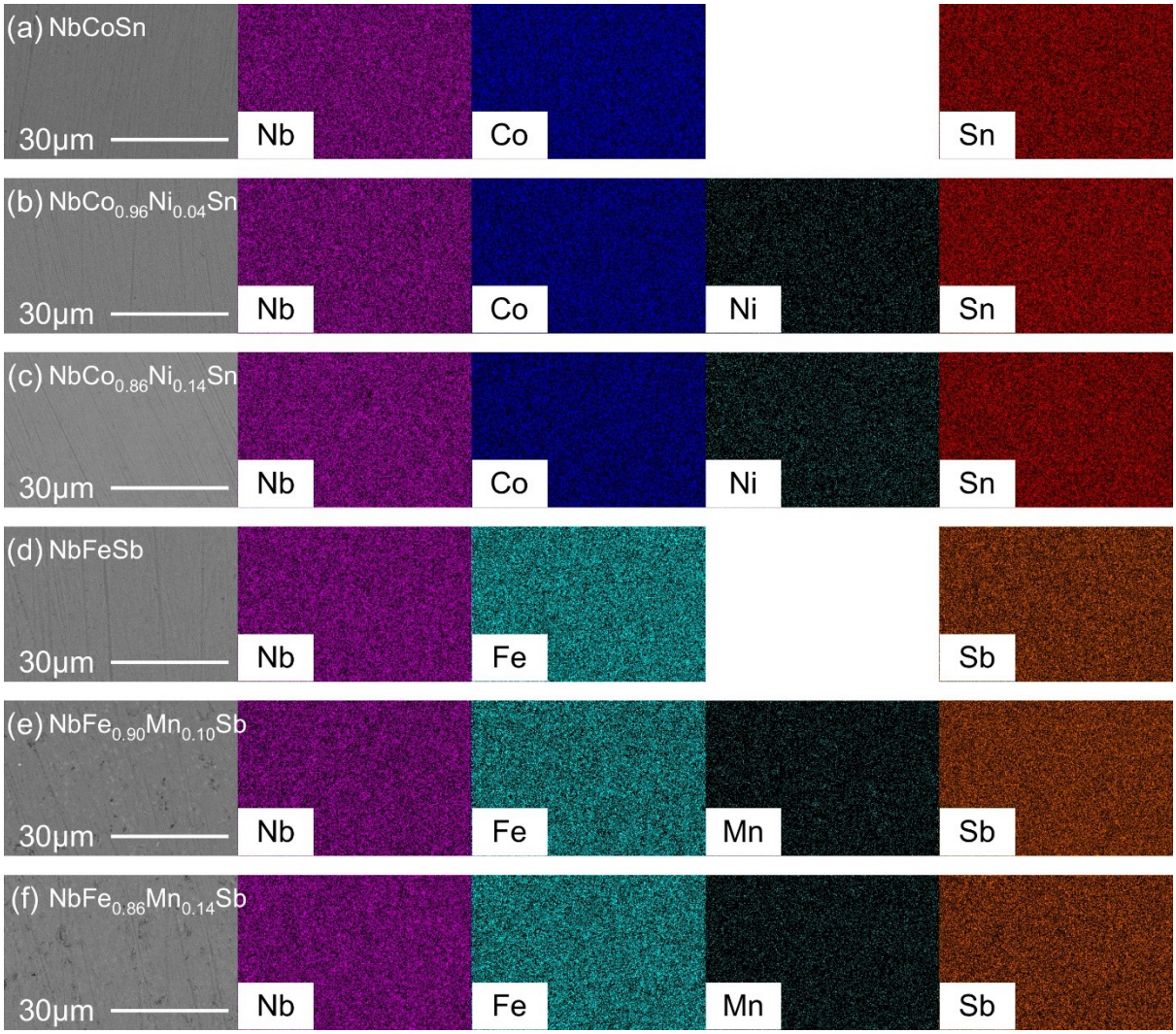

Fig. S2

Energy-dispersive X-ray spectroscopy (EDS) mapping and backscattered electron (BSE) images of (a) NbCoSn, (b) $NbCo_{0.96}Ni_{0.04}Sn$, (c) $NbCo_{0.86}Ni_{0.14}Sn$, (d) NbFeSb, (e) $NbFe_{0.90}Mn_{0.10}Sb$, (f) $NbFe_{0.86}Mn_{0.14}Sb$.

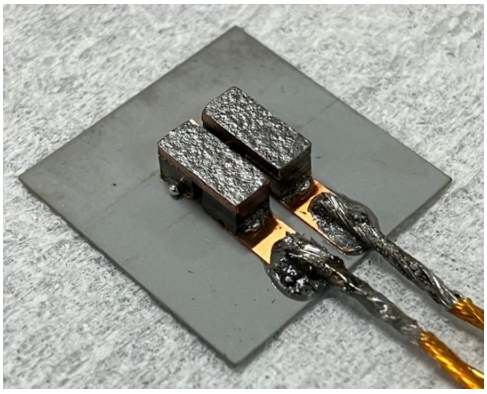

Fig. S3

2π-module based on pair of *n*-type $NbCo_{0.90}Ni_{0.10}Sn$ and *p*-type $NbFe_{0.96}Mn_{0.04}Sb$.

20 × 20 mm^2 Si_3N_4 ceramics substrate with height of 0.32 mm.

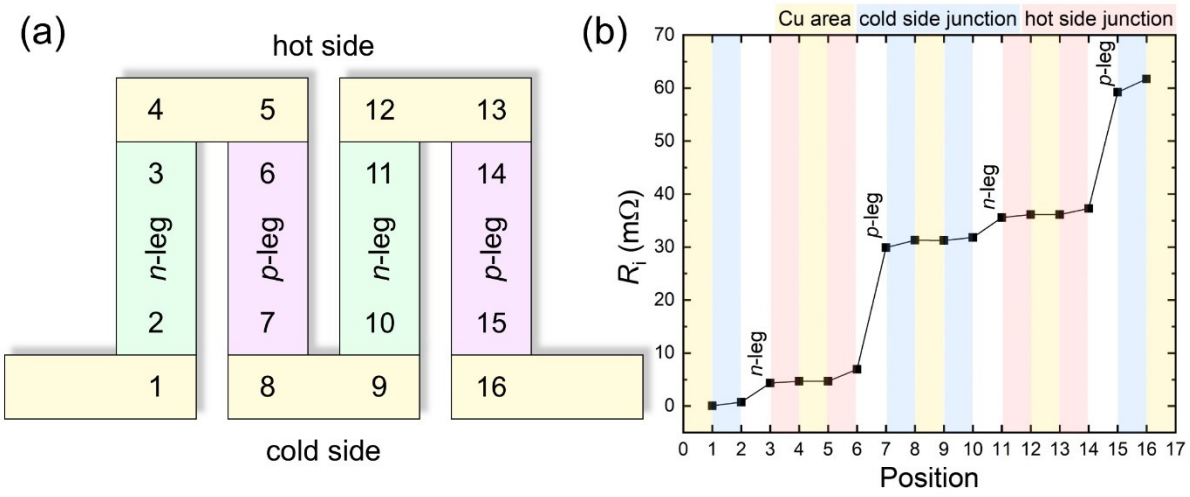

Fig. S4

(a) a schematic of the 2π-module displaying the positions for resistance measurement, as shown in (b).

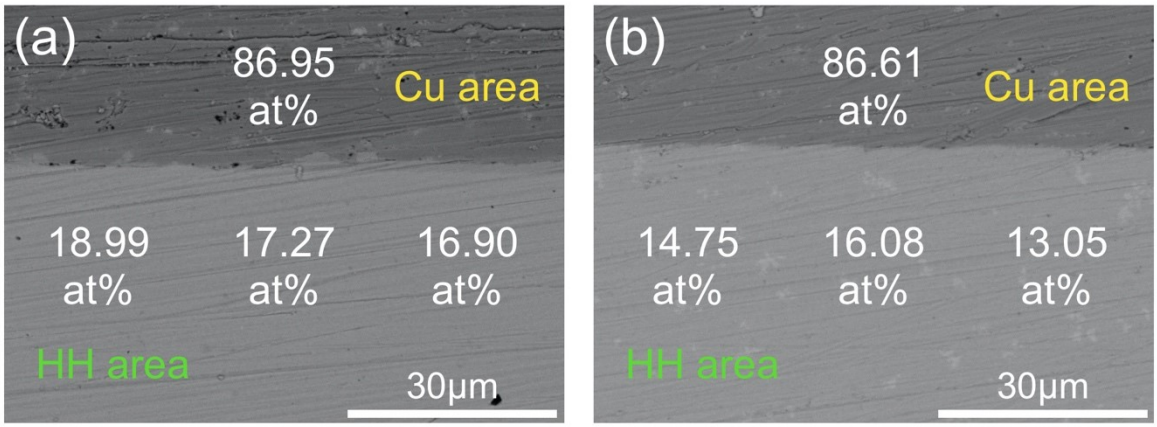

Fig. S5

Nominal atomic percentage of EDS mapping at Cu and (a) $NbCo_{0.90}Ni_{0.10}Sn$, and (d) $NbFe_{0.96}Mn_{0.04}Sb$ junction. Atomic percentage of Cu is shown in backscattered electron (BSE) images at difference observed areas.

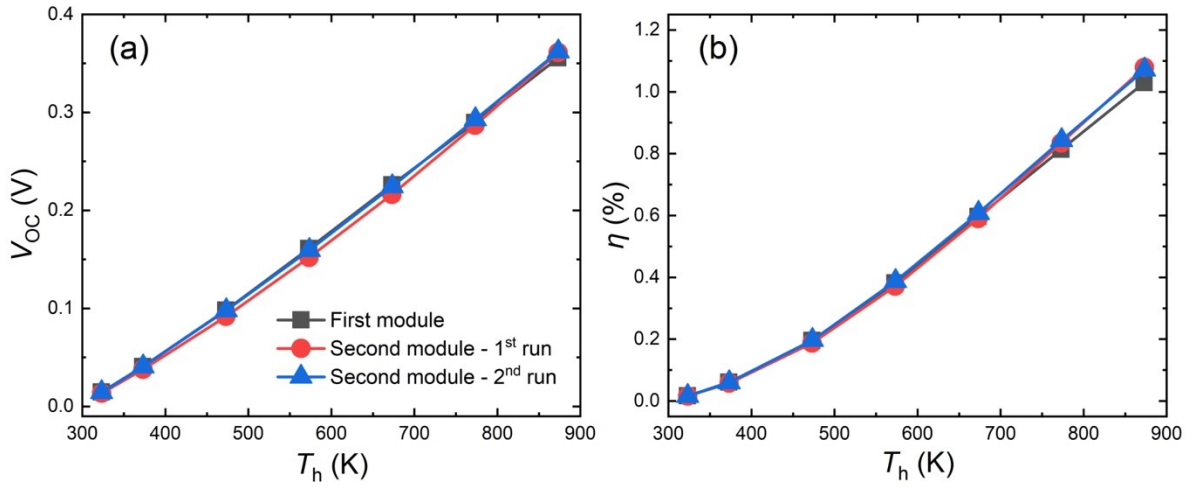

Fig. S6

The reproducibility of the 2π-HH modules for (a) open-circuit voltage (V_{OC}) and (b) maximum conversion efficiency (η_{max}).