Supplementary Information   RSC Advances

High efficiency Mg_2(Si, Sn) based thermoelectric materials: scale-up synthesis, functional homogeneity, and thermal stability

Nader Farahi *, Christian Stiewe, D. Y. Nhi Truong, Johannes de Boor, and Eckhard Müller

[a] Institute of Materials Research, German Aerospace Center (DLR), D-51170 Köln, Germany, nfarahi@uwaterloo.ca

[b] Institute of Inorganic and Analytical Chemistry, Justus Liebig University Gießen, D-35392 Gießen, Germany
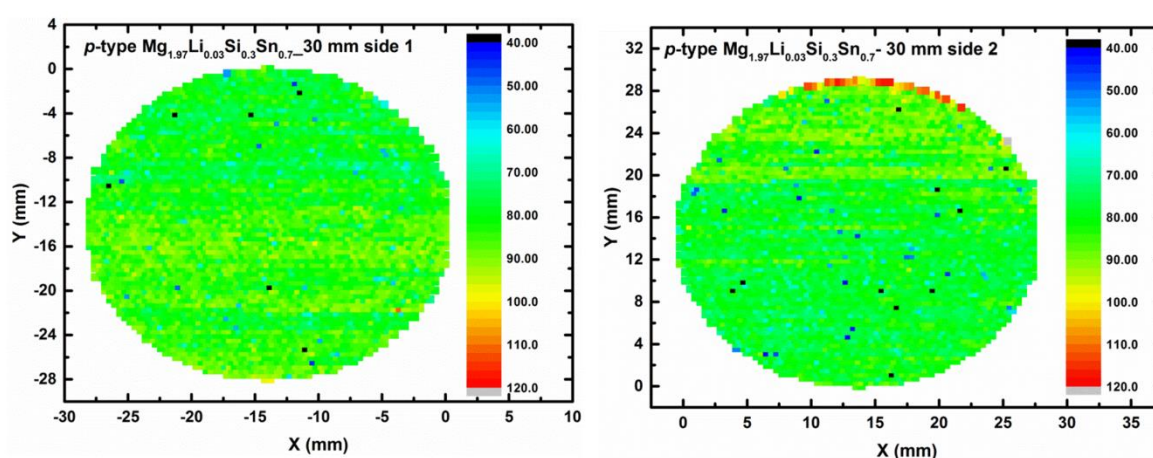

Fig. S1. Surface Seebeck scans of both base faces of the Ø30 mm $Mg_{1.97}Li_{0.03}Si_{0.3}Sn_{0.7}$ pellet (error 5%).
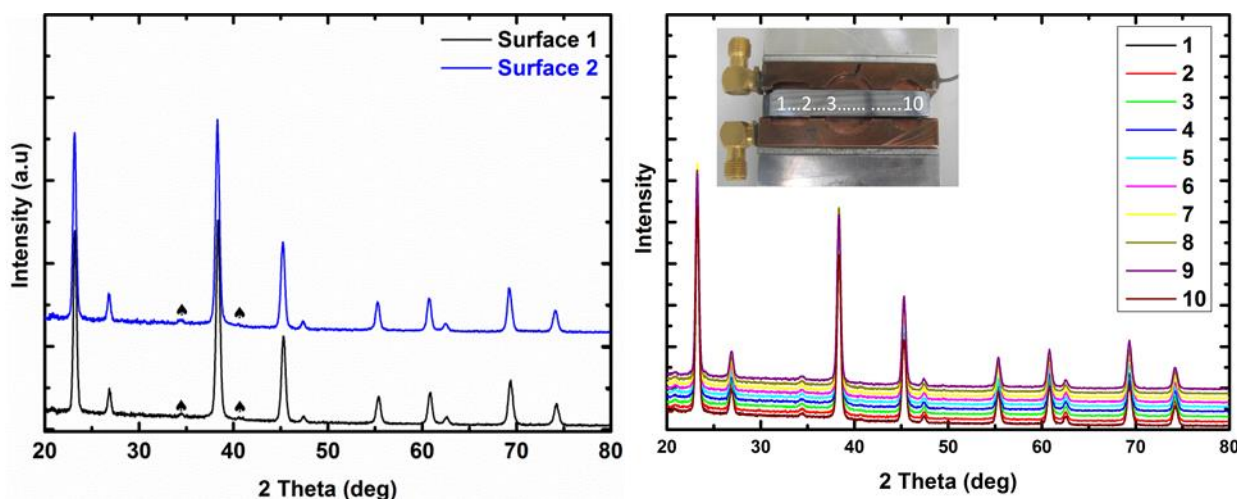

Fig. S2. X-ray diffraction patterns on the both surfaces and the cross section (left) and ten different points on cross section (right) of the Ø50 mm $Mg_2Si_{0.3}Sn_{0.675}Bi_{0.025}$ sample.

Table S1. Density and calculated specific heat of four samples extracted from the Ø50 mm pellet.

Sample	Density (g·cm^{-3}) (Archimedes method)	Specific Heat (J·g^{-1}·K^{-1}) (Dulong-Petit approximation)
I	3.11 (> 98% theoretical density)	0.514
II	3.14 (> 98% theoretical density)	0.514
III	3.13 (> 98% theoretical density)	0.514
IV	3.14 (> 98% theoretical density)	0.514

Table S2. Density and calculated specific heat of three samples extracted from the Ø70 mm pellet.

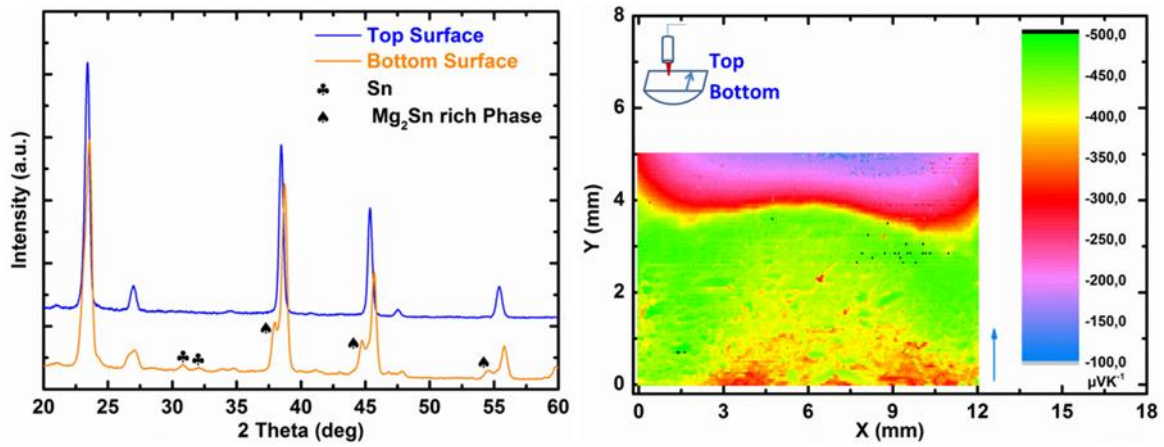| Sample	Density (g·cm^{-3}) (Archimedes method)	Specific Heat (J·g^{-1}·K^{-1}) (Dulong-Petit approximation)
I	3.15 (> 98% theoretical density)	0.514
II	3.14 (> 98% theoretical density)	0.514
III	3.13 (> 98% theoretical density)	0.514

Fig. S3. X-ray diffraction patterns on the top and bottom surfaces (left) and surface Seebeck scan on cross section (right) of the $Mg_2Si_{0.3}$ $Sn_{0.675}Bi_{0.025}$ sample with current passing through the sample.
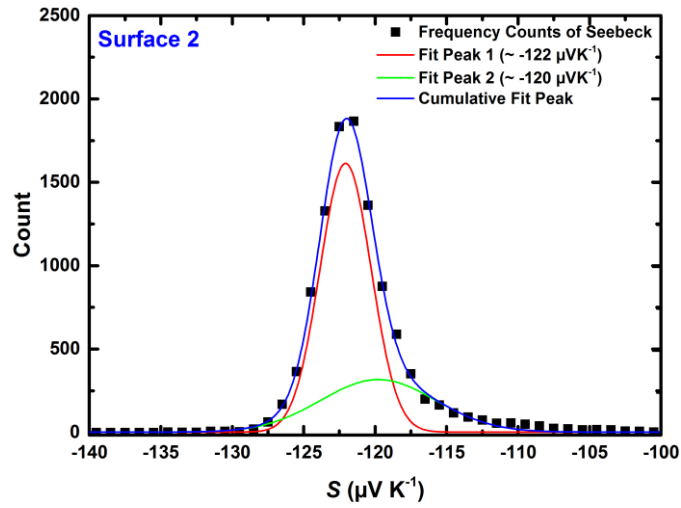
Fig. S4. Frequency count of surface Seebeck scan performed on one of the two surfaces of the Ø50 mm $Mg_2Si_{0.3}Sn_{0.675}Bi_{0.025}$ sample.
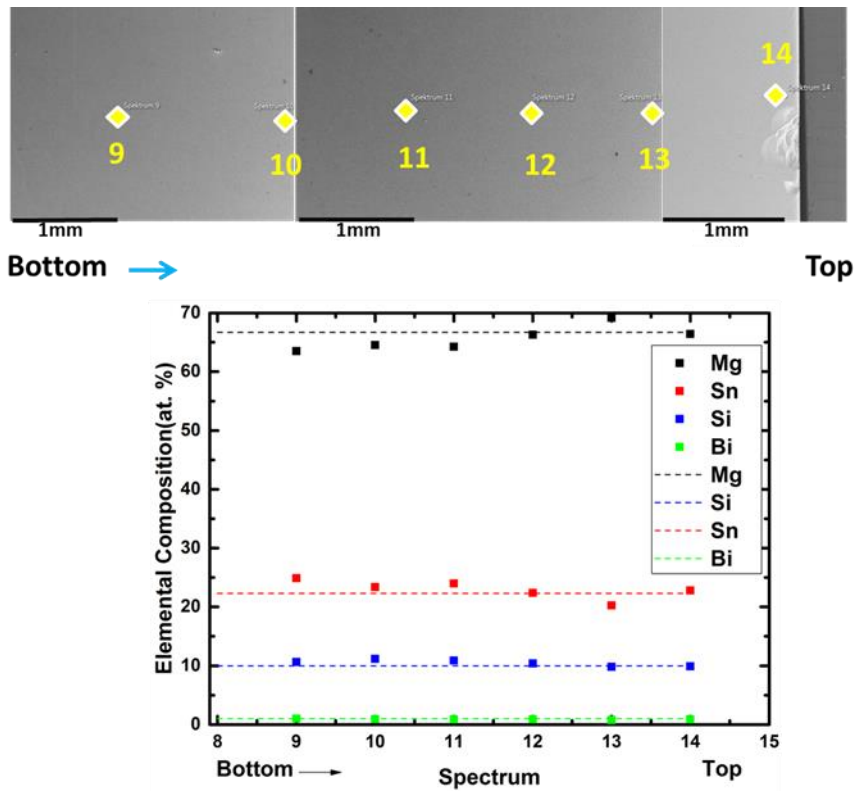

Fig. S5. SEM image (top) together with EDX analysis (bottom) along the cross section of the Ø50 mm $Mg_2Si_{0.3}Sn_{0.675}Bi_{0.025}$ sample. The dash lines represent the nominal compositions.

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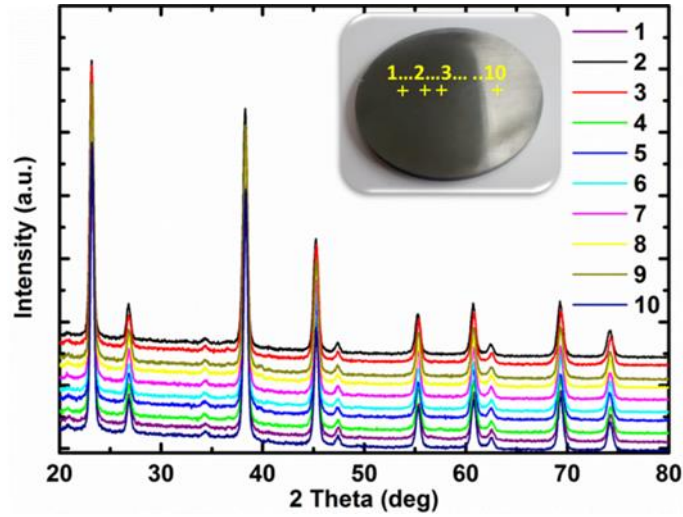Fig. S6. XRD patterns on the surface of the Ø70 mm $Mg_2Si_{0.3}Sn_{0.675}Bi_{0.025}$ sample.

Table S3. Thermoelectric properties of three samples extracted from the Ø70 mm pellet before and after heat treatment at ~ 773 K.

Thermoelectric properties	1 (168 h)	2 (336 h)	3 (720 h)
$\sigma/(\Omega^{-1}cm^{-1})$*	1051/1049	1025/1000	1020/997
$S/(\mu V\ K^{-1})$*	−198/-201	−198/-201	−198/-209

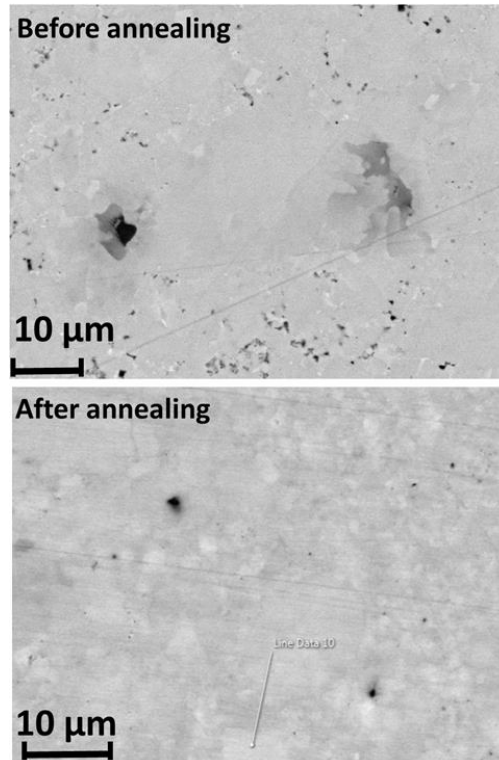*properties compared at 773 K, before annealing/ after annealing.

Fig. S7. SEM image of the sample (top) before and (bottom) after heat treatment at 723 K for 720 hours.