## Supplementary information

Mechanical Alloying of Optimized $\mathbf{M g}_{2}(\mathbf{S i}, \mathbf{S n})$ Solid Solutions: Understanding Phase Evolution and Tuning Synthesis Parameters for Thermoelectric Applications<br>Aryan Sankhla ${ }^{\text {a }}$ * , Akash Patil $^{\text {a }}$, Hasbuna Kamila ${ }^{\text {a }}$, Mohammad Yasseri ${ }^{\text {a,b }}$, Nader Farahi ${ }^{\text {a }}$, Eckhard Mueller ${ }^{\text {a,b }}$, Johannes de Boor ${ }^{\text {a }}$ *<br>${ }^{\dagger}$ Equal Contributions to the work.<br>${ }^{a}$ Institute for Materials Research, Linder Hoehe, German Aerospace Center (DLR), D - 51170 Koeln, Germany.<br>${ }^{\mathrm{b}}$ Institute of Inorganic and Analytical Chemistry, Justus Liebig University of Giessen, D 35392 Giessen, Germany.

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Table S1 Showing the change in the Ball-to-Powder ratio with increasing time of Mechanical alloying

| Time (in hours) | Stainless Steel <br> Vial 1 | Stainless Steel <br> Vial 2 | BPR Vial 1 | BPR Vial 2 |
| :---: | :---: | :---: | :---: | :---: |
| 0.5 | P1 (0.75 g) | P1 (0.75g) | 1.7 | 1.7 |
| 1 | P2 (0.75g) | P2 (0.75g) | 1.9 | 1.9 |
| 2 | - | P3 (1.25g) | 1.9 | 2.2 |
| 4 | P3 (1.25g) | - | 2.2 | 2.2 |
| 6 | - | P4 (1.25g) | 2.2 | 2.7 |
| 10 | P4 (1.25g) | - | 2.7 | 2.7 |
| 15 | - | P5 (1.25g) | 2.7 | 3.4 |
| 20 | P5 (1.25g) | - | 3.4 | 3.4 |
| 25 | - | P6 (1.25g) | 3.4 | 4.6 |
| 30 | P6 (1.25g) | - | 4.6 | 4.6 |
| 35 | P7 (1.25g) | P7 (1.25g) | 7.1 | 7.1 |



Figure S1 Plot showing particle size curves for the sample powder milled for different hours


Figure S2 SEM of 4h powder cross section



Figure S3 SEM of 20h powder cross section



Figure S4 SEM of 35h powder cross section


Figure $\mathbf{S 5}$ Surface electron micrograph on different areas of the sample MS-2-973/20 showing grain size (a) Area 1 (b) Area 2


Figure S6 XRD pattern of the sample obtain after sintering powder milled for $35 h$


Figure S7 Surface Seebeck scans of MS-20-973/20 and MS-20-973/10 sample showing homogeneity on the top surface. The frequency counts for the determination of Seebeck coefficient is also presented)

