## **Supporting Information**

## Realizing enhance thermoelectric performance in n-type Mg<sub>3</sub>(Bi,Sb)<sub>2</sub>-based film

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Figure SI. 1: XRD patterns of synthesized target with composition Mg<sub>3.2</sub>Bi<sub>1.5</sub>Sb<sub>0.5.</sub>



Figure SI. 2: XRD patterns obtained for films S1, S2, S3 and S4.



Figure SI. 3: SEM image for S1 deposited at room temperature showing Bi-rich region (marked by yellow arrow).



Figure SI 4: (a-b) FESEM micrograph with (c-e) elemental mappings and (f) EDS spectra for S5 ( $T_D = 200 \text{ °C}$ ).



Figure SI. 5: SEM image at (a) low magnification with 10  $\mu$ m scale bar, (b-f) high magnification with 1  $\mu$ m scale bar and inset table of elemental's composition for each spectrum (marked by magenta rectangle) of R2 film.



Figure SI. 6: Deposition power ( $P_D$ ) dependence Seebeck coefficient and electrical conductivity at room temperature for S1, S2, and S3.