Supplementary Material (ESI) for *Energy & Environmental Science*

Electronic Supplementary Information

Recrystallization induced in situ nanostructures in bulk bismuth antimony tellurides: a simple top down route and improved thermoelectric properties

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Informations about hot forging process

There is a puzzle that possibly the sample would be crushed and then sintered again or just plastically deformed during the hot forging process. Therefore, a small compression test was done as below: After the ϕ 10 mm disk-shaped BST-O sample were put into a larger graphite die of ϕ 12.7 mm and heated to 723K, a lower pressure has been used for a short time press to simulate the hot forging process. The drum-like intermediate shape of the sample has been gotten as shown in Figure S2, indicating that the sample continuously deformed during hot press and not crushed. On the other hand, as shown in Figure S3, a simple three-point bending test was also carried out from room temperature to 573K at a load of 5N to confirm the plasticity of the Bi_2Te_3 based alloys.

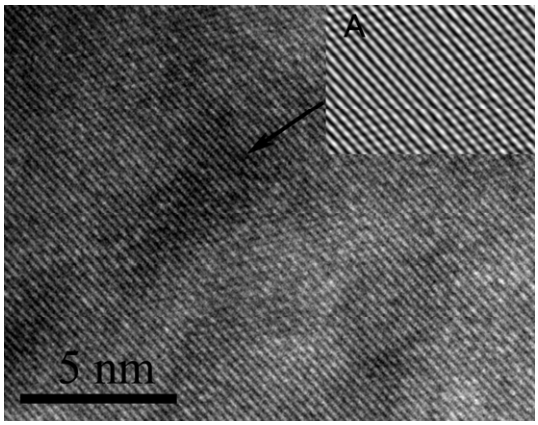

Figure S1. HRTEM image of the initial hot pressed sample without hot forging.

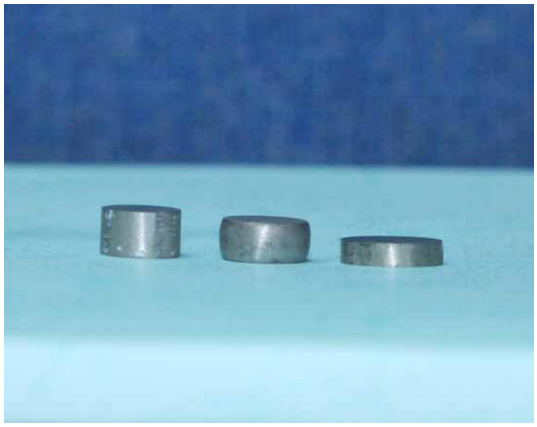

Figure S2. Photographs of the $Bi_{0.5}Sb_{1.5}Te_3$ samples: 'initial ϕ10 mm disk, the deformed sample, and the final ϕ12.7 mm disk' from left to right, indicating that the sample continuously deformed during hot press.

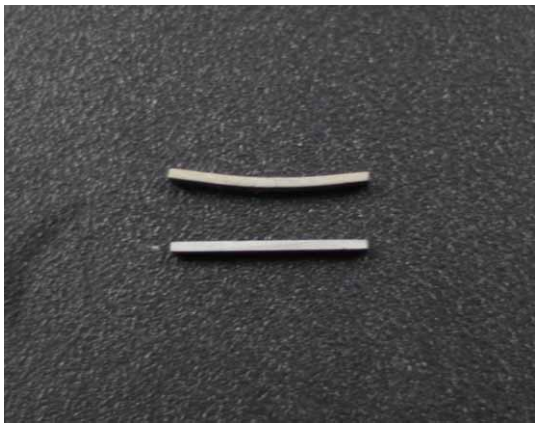

Figure S3. Photograph of the $Bi_{0.5}Sb_{1.5}Te_3$ bars before and after simple three-point bending test from room temperature to 573K at a load of 5N.

Table S1. Thermal diffusivity, specific heat and relative density at room temperature of the samples before and after hot-forging.

Sample	BST-O	BST-A	BST-R
Thermal diffusivity D (mm^2/s)	0.638	0.574	0.532
Specific heat Cp (J/gK)	0.214	0.215	0.213
Relative density (%)*	99.5	99.7	99.4

*With regard to the theoretical density of 6.88 g/cm^3