**Supplementary Information**

**Thermoelectric and mechanical properties of PLA/Bi0.5Sb1.5Te3 composite wires used for 3D printing**

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**Thermal conductivity measurement**

The thermal conductivity of the composite wires was measured by a home-made setup as shown in Figs. S1 and S2. The fracture surface of a sample was softly polished by sandpapers to obtain a flat surface. The polished surface was painted by a black pen. Two holes were drilled on the cylindrical surface with a distance of about 5mm, and the two thermocouples were buried into the holes to monitor the temperatures at these two positions. A laser beam was irradiated at the center of the polished surface with a fixed distance. The thermal conductivity *κ* of the composite wires was obtained with Equation (1) below.

, (1)

where *Q* is the heat flux, *A* is the area of the fracture surface of the wire, *T1* and *T2* are the temperatures measured by the two thermocouples, and *L* is the distance between the two thermocouples [1].

A pure PLA wire, BST/PLA composite wire with 87.5 wt.% BST, and BST/MWCNTs/PLA composite wire with 4 wt.% MWCNTs and 81.3 wt.% BST were measured and the experimental data were shown in Table SI. The *κ* of pure PLA (0.21 Wm-1K-1) was obtained in our previous study [2] . The *Q* was assumed to be the same for all samples because the distance of laser irradiation was fixed. Then, the *κ* of the composite wires was calculated with Equation (1).



Figure S1. Schematic of the home-made setup to measure the thermal conductivity of composite wires.



Figure S2. Photograph of the home-made setup with a laser generator.

Table SI. Experimental parameters of pure PLA wire, BST/PLA composite wire with 87.5 wt.% BST, and BST/MWCNTs/PLA composite wire with 4 wt.% MWCNTs and 81.3 wt.% BST.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | ***L***  **(mm)** | **△*T***  **(K)** | **Wire diameter**  **(mm)** | ***κ***  **(Wm-1K-1)** |
| **Pure PLA** | 4.76±0.02 | 9.8±0.2 | 3.02±0.02 | 0.21±0.01 |
| **BST/PLA** | 4.78±0.02 | 8.3±0.4 | 2.60±0.02 | 0.34±0.03 |
| **BST/MWCNTs/PLA** | 4.72±0.02 | 8.4±0.5 | 2.66±0.02 | 0.31±0.03 |

References:

[1] P.L. Garrido, P.I. Hurtado, B. Nadrowski, Simple one-dimensional model of heat conduction which obeys fourier’s law, Phys. Rev. Lett. 86(24) (2001) 5486.

[2] S.-H. Su, Y. Huang, S. Qu, W. Liu, R. Liu, L. Li, Microdiamond/PLA composites with enhanced thermal conductivity through improving filler/matrix interface compatibility, Diamond Relat. Mater. 81 (2018) 161-167.