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SUPPLEMENTARY INFORMATION

Bottom-up engineering of thermoelectric nanomaterials and devices from solution-processed nanoparticle building blocks

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1. State-of-the-art solution-processed ZT materials

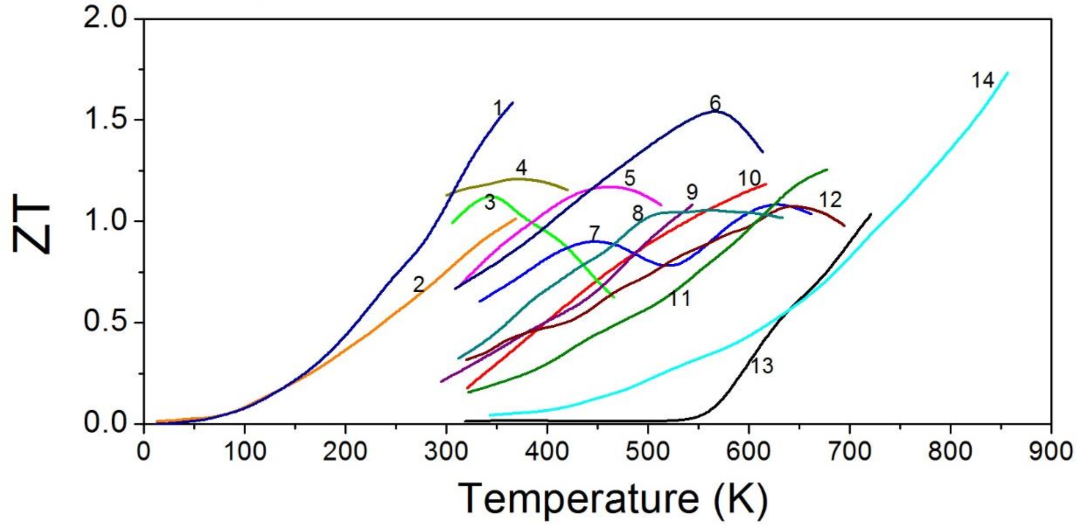

Figure S1. State-of-the-art ZT values obtained from solution-processed nanoparticle-based thermoelectric materials. **p-type**: **1.** $Bi_{0.5}Sb_{1.5}Te_3$[1], **4.** $Bi_{0.5}Sb_{1.5}Te_3$[2], **6.** $(Ag_2Te)_5(Sb_2Te_3)_5$[3], **8.** PbTe-BiSbTe[4], **9.** $AgBi_{0.5}Sb_{0.5}Se_2$[5], **11.** $Cu_3Sb_{0.88}Sn_{0.10}Bi_{0.02}Se_4$[6] and **12.** $AgSb_{0.98}Bi_{0.02}Se_2$[7]. **n-type**: **2.** $Bi_2Te_{2.7}Se_{0.3}$[1], **3.** $K_{0.06}Bi_2Te_{3.18}$[8], **5.** $Bi_2Te_{2.5}Se_{0.5}$[9], **7.** $PbTe_{0.66}Se_{0.33}$[10], **10.** PbTe-Bi_2Te_3[11], **13.** $(PbTe)_{0.72}(PbS)_{0.28}$[12] and **14.** PbS-Ag 4.4%[13]

2. Solution-processed nanoparticle-based thermoelectric devices

Table S1. Key parameters from solution-processed nanoparticle-based thermoelectric devices.

Reference / Material	Deposition Method	Substrate	n° pairs & architecture	Output Power	Flexible?
[14] **Bi_2Te_3-epoxy Sb_2Te_3-epoxy**	Dispenser Printing	Polyimide	50 in-plane	171.6 mV, 10.5 µW, 75 µW/cm^2 @ ΔT= 20 °C	Yes
[15] **ZnSb $CoSb_3$**	Screen Printing	Alumina	2 through-plane	27 mV, 0.1 mW/cm^2 @ ΔT= 50 °C	No
[16] **PbTe**	Dip Coating	Glass Fibers	-	1.7 mV @ ΔT= 58 °C	Yes
[17] **-**	Dispenser Printing	PDMS	- through-plane	7 mV, 2.1 µW @ ΔT= 19 °C	Yes
[18] **$Bi_{0.5}Sb_{1.5}Te_3$/ Te-epoxy**	Dispenser Printing	Polyimide	60 in-plane	152 µW/cm^2 @ ΔT= 20 °C	Yes
[19] **$Sb_{1.5}Bi_{0.5}Te_3$ $Bi_2Te_{2.7}Se_{0.3}$**	Inkjet Printing	Polyimide	3 in-plane	PF @ 75 °C p-type 77 µWm^{-1}K^{-2} n-type 183 µWm^{-1}K^{-2}	Yes
[20] **Bi_2Te_3 Sb_2Te_3**	Screen Printing	Glass Fabric	11 through-plane	2.9 mV, 3 µW @ ΔT= 20 °C	Yes
			8 through-plane	90 mV, 3.8 mW/cm^2 @ ΔT= 50 °C	
[21] **I-doped PbTe**	Dip Coating	Glass	2 in-plane	43 mV @ ΔT= 27 °C	No
[22] **Bi_2Te_3 Sb_2Te_3**	Screen Printing	Polyimide	8 in-plane	36.4 mV, 40.3 nW @ ΔT= 20 °C	Yes
[23] **Bi-epoxy $Bi_{0.5}Sb_{1.5}Te_3$/ Te-epoxy**	Dispenser Printing	Polyimide	10 in-plane	1230 µW/cm^2 @ ΔT= 70 °C	Yes
[24] **Bi_2Te_3 Sb_2Te_3 PEDOT:PSS**	Screen Printing	Polyimide	7 in-plane	85.2 mV, 1.22 mW/cm^2 @ ΔT= 50 °C	Yes
[25] **Bi_2Se_3 nanoplates/ PVDF**	Drop-casting	Free-standing TE foil	N/A	90 mV @ ΔT= 1.2 °C	Yes
[26] **Ag_2Te/**	Dip Coating	Nylon fibers	2 in-plane	3.5 mV, 5 nW, 0.6 µW/cm^2 @ ΔT= 20 °C	Yes

PEDOT:PSS					
[27] **Bi_2Te_3 $Bi_{0.5}Sb_{1.5}Te_3$**	Dispenser Printing	Polyimide	25 in-plane	33 µW, 2.8 W/m^2 @ ΔT= 20 °C	Yes
[28] **$Cu_{1.75}Te$ NWs /PVDF**	Vacuum Filtration	Free-standing TE foil	N/A	PF = 23 $\mu Wm^{-1}K^{-2}$ @ 25 °C	Yes
[29] **WS_2 NSs $NbSe_2$ NSs**	Vacuum Filtration/ Contact Printing	PDMS	100 through-plane	38 nW @ ΔT= 60 °C	Yes
[30] **Bi_2Te_3 Sb_2Te_3**	Dispenser Printing	Polyimide	1 through-plane	1.54 nW @ ΔT= 20 °C	Yes
[31] **$Ca_3Co_4O_9$**	Screen Printing	Alumina	10 in-plane	PF = 0.16 $mWm^{-1}K^{-2}$ @ 300 °C	No
[31] **$(ZnO)_5In_2O_3$**			10 in-plane	PF = 1.4 $\mu Wm^{-1}K^{-2}$ @ 300 °C	No
[32] **$Bi_{0.5}Sb_{1.5}Te_3$**	3D Printing	Free-standing TE pellet	N/A	ZT = 0.12 @ 43 °C	No
[33] **$Bi_2Te_{2.8}Se_{0.2}$**	Screen Printing	Polyimide	5 in-plane	ZT = 0.43 @ 175 °C 6.1 $\mu W/cm^2$, 4.1 mW/cm^2 @ ΔT= 60 °C	Yes
[34] **TiS_2/ hexylamine**	Drop-casting	Free-standing TE foil	N/A	32 $\mu W/cm^2$ @ ΔT= 20 °C	Yes
[35] **PbS QDs Bi-doped PbTe QDs**	Dip Coating	Cellulose paper	3 in-plane	21.1 mV @ ΔT= 33 °C	Yes
			3 through-plane	14.2 mV @ ΔT= 33 °C	Yes
[36] **Bi_2Te_3 Sb_2Te_3**	Dispenser Printing	Silk Fabric	12 through-plane	10 mV, 15 nW @ ΔT= 35 °C	Yes
[37] **Bi_2Te_3/ Sb_2Te_3 ChaM**	Brush-painting	Polyimide or Glass	5 in-plane	2.43 mW/cm^2 @ ΔT= 50 °C	Yes/No
		Alumina	1 through-plane	4 mW/cm^2 @ ΔT= 50 °C	No
[38] **Ag Ni**	Screen Printing	Polyimide	15 in-plane	22 mV, 14.6 µW @ ΔT= 113 °C	Yes
[39] **$Bi_{1.8}Te_{3.2}$ Sb_2Te_3**	Screen Printing	Polyimide	8 in-plane	26.6 mV, 455.4 nW @ ΔT= 20 °C	Yes
		Glass fibers fabric	8 in-plane	42 mV, 2.3 µW @ ΔT= 20 °C	Yes
[40] **$(Bi_{0.98}Sb_{0.02})_2$ $(Te_{0.9}Se_{0.1})_3$ $(Bi_{0.25}Sb_{0.75})_2$ $(Te_{0.95}Se_{0.05})_3$**	Dispenser Printing	Polyester fabric	12 through-plane	23.9 mV, 3.11 nW @ ΔT= 22.5 °C	Yes
[41]	Screen Printing	PDMS	72	4.78 mW/cm^2 @ ΔT= 25 °C	Yes

$Bi_{0.3}Sb_{1.7}Te_3$ $Bi_2Se_{0.3}Te_{2.7}$			through-plane		
[42] **$Bi_2Te_{2.7}Se_{0.3}$ $Bi_{0.5}Sb_{1.5}Te_3$**	Brush-painting	Alumina	4 in-plane	ΔT= 3.7 °C @ 0.3 A cooling performance	No
[43] **$Bi_{1.8}Te_{3.2}$ Sb_2Te_3**	Screen Printing	Polyimide	8 in-plane	32 mV, 444nW @ ΔT= 20 °C	Yes
[44] **TiS_2/organic PEDOT:PSS**	Contact Printing	PET	5 in-plane	33 mV, 2.5 W/m^2 @ ΔT= 70 °C	Yes
[45] **Bi_2Te_3 NWs Te-PEDOT:PSS**	Vacuum Filtration	Free-standing TE foil	6 in-plane	56 mV, 32 μW/cm^2 @ ΔT= 60 °C	No
[6] **Sn- Bi-doped Cu_3SbSe_4**	Filling	Cu rings	N/A	20 mV, 1 mW @ ΔT= 160 °C	No

3. Electron microscopy micrographs of solution-processed nanoparticle building blocks

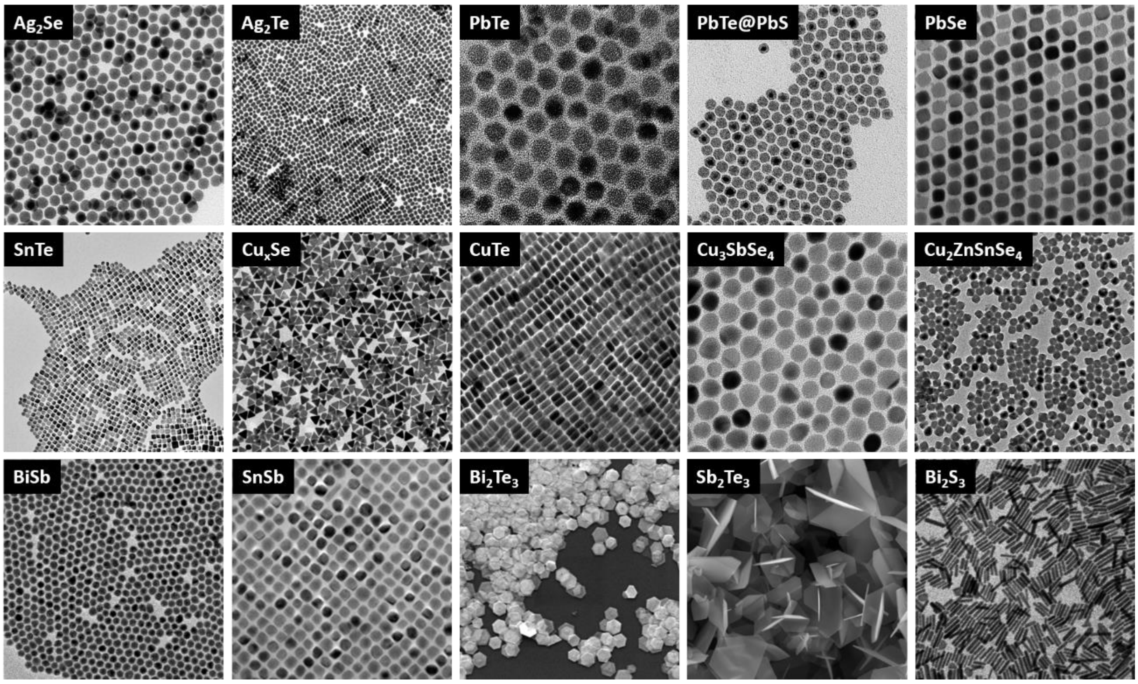

Figure S2. Selection of solution-processed nanoparticles produced by the authors of this review following reported synthesis procedures: Ag_2Se,[46] Ag_2Te,[46] PbTe,[12] PbTe@PbS,[12] PbSe,[12] SnTe,[47] Cu_xSe,[48] CuTe,[49] Cu_3SbSe_4,[6] $Cu_2ZnSnSe_4$,[50] BiSb,[51] SnSb,[51] Bi_2Te_3,[2] Sb_2Te_3,[2] Bi_2S_3.[52]

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