Supporting Information

Nanostructured SnSe Integrated with Se Quantum Dot with Ultrahigh Power Factor and Thermoelectric Performance from Magnetic Field-Assisted Hydrothermal Synthesis

Rui Xu,1 Lulu Huang,2,6 Jian Zhang,2 Di Li,2,* Jizi Liu,3,* Jiang Liu,1 Jun Fang,4 Meiyu Wang,5 Guodong Tang1,*

1MIIT Key Laboratory of Advanced Metallic and Intermetallic Materials Technology, School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing 210094, China.
2Key Laboratory of Materials Physics, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, China.
3Materials Characterization & Research Center, School of Materials Science and Engineering, Nanjing University of Science and Technology, Jiangsu 210094, China.
4Anhui Province Key Laboratory of Condensed Matter Physics at Extreme Conditions, High Magnetic Field Laboratory of the Chinese Academy of Science, Hefei 230031, Anhui, China.
5National Laboratory of Solid State Microstructures, College of Engineering and Applied Sciences and Collaborative, Innovation Center of Advanced Microstructures, Nanjing University, Nanjing 210093, P. R. China.
6University of Science and Technology of China, Hefei 230026, China.
* To whom correspond should be addressed.
E-mail: tangguodong@njust.edu.cn (G.T.); lidi@issp.ac.cn (D.L.); jzliu@njust.edu.cn (J.L.)
Content:

Table S1

Table S2

Figure S1

Figure S2

Figure S3

Figure S4

Figure S5
**Table S1.** Sample density of 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites and Sn$_{0.99}$Pb$_{0.01}$Se by Archimedes method.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Density [g cm$^{-3}$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>5.93</td>
</tr>
<tr>
<td>5 T Se quantum dot/Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>5.96</td>
</tr>
<tr>
<td>9 T Se quantum dot/Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>5.93</td>
</tr>
</tbody>
</table>
Table S2. The lattice parameters extracted from the XRD Rietveld refinement for 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites and Sn$_{0.99}$Pb$_{0.01}$Se.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Magnetic field intensity</th>
<th>a(Å)</th>
<th>b(Å)</th>
<th>c(Å)</th>
<th>Volume(Å$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>0 T</td>
<td>11.52(5)</td>
<td>4.16(9)</td>
<td>4.44(5)</td>
<td>213.6</td>
</tr>
<tr>
<td>Se quantum dot/Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>5 T</td>
<td>11.52(8)</td>
<td>4.16(9)</td>
<td>4.44(8)</td>
<td>213.77</td>
</tr>
<tr>
<td>Se quantum dot/Sn$<em>{0.99}$Pb$</em>{0.01}$Se</td>
<td>9 T</td>
<td>11.52(4)</td>
<td>4.16(8)</td>
<td>4.45(6)</td>
<td>214.0</td>
</tr>
</tbody>
</table>
**Figure S1.** EBSD microstructure of 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites and Sn$_{0.99}$Pb$_{0.01}$Se. (a), (d) and (g) are band contrast images of Sn$_{0.99}$Pb$_{0.01}$Se, 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, respectively; (b), (e) and (h) are Euler images of Sn$_{0.99}$Pb$_{0.01}$Se, 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, respectively; (c), (f) and (i) are inverse pole figures of Sn$_{0.99}$Pb$_{0.01}$Se, 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, respectively.
**Figure S2.** EDS maps of Se, Zn and Pb with corresponding HAADF-STEM image.
Figure S3. EBSD microstructure of 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites and Sn$_{0.99}$Pb$_{0.01}$Se. (a), (c) and (e) are band contrast images of Sn$_{0.99}$Pb$_{0.01}$Se, 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, respectively; (b), (d) and (f) are grain size distribution histograms of Sn$_{0.99}$Pb$_{0.01}$Se, 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, respectively.
Figure S4. A comparison of electrical properties perpendicular to the direction of pressure and parallel to the direction of pressure for 5 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposite. (a) Electrical conductivity ($\sigma$). (b) Seebeck coefficient ($S$). (c) Power factor ($PF$).
Figure S5. Lorenz number as a function of temperature for 5 T and 9 T Se quantum dot/Sn$_{0.99}$Pb$_{0.01}$Se nanocomposites, Sn$_{0.99}$Pb$_{0.01}$Se and SnSe.