Supporting information for

High Performance Sm-Doped Pb(Mg$_{1/3}$Nb$_{2/3}$)O$_3$-PbZrO$_3$-PbTiO$_3$ Based Piezoceramics

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Figure S1. (a) The XRD patterns (Cu Kα1) of Sm-doped PMN-PZ-xPT ceramics; (b) enlarged XRD patterns of Sm-doped PMN-PZ-xPT ceramics in the vicinity of 2θ=44°-46°.

Table S1. Refined results of Sm-doped PMN-PZ-xPT ceramics using R3m and P4mm space group.

<table>
<thead>
<tr>
<th>Composition</th>
<th>Structure</th>
<th>Fraction (%)</th>
<th>Lattice parameters</th>
<th>Agreement factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>x=0.332</td>
<td>R3m</td>
<td>100</td>
<td>a=4.0484 Å, α=89.928°</td>
<td>3.67, 5.11, 2.84</td>
</tr>
<tr>
<td></td>
<td>P4mm</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>x=0.342</td>
<td>R3m</td>
<td>78.4</td>
<td>a=4.0473 Å, α=89.937°</td>
<td>3.79, 5.07, 2.91</td>
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<td></td>
<td>P4mm</td>
<td>21.6</td>
<td>a=4.0418 Å, c=4.0593 Å</td>
<td></td>
</tr>
<tr>
<td>x=0.352</td>
<td>R3m</td>
<td>30.3</td>
<td>a=4.0447 Å, α=89.961°</td>
<td>3.68, 5.02, 3.06</td>
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<tr>
<td></td>
<td>P4mm</td>
<td>69.7</td>
<td>a=4.0301 Å, c=4.0695 Å</td>
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</tr>
<tr>
<td>x=0.362</td>
<td>R3m</td>
<td>13.8</td>
<td>a=4.0425 Å, α=89.971°</td>
<td>4.09, 5.82, 2.93</td>
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<td></td>
<td>P4mm</td>
<td>86.2</td>
<td>a=4.0254 Å, c=4.0743 Å</td>
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<tr>
<td>x=0.372</td>
<td>R3m</td>
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<td>5.39, 7.48, 2.96</td>
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<tr>
<td></td>
<td>P4mm</td>
<td>100</td>
<td>a=4.0223 Å, c=4.0761 Å</td>
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</tr>
</tbody>
</table>
**Table S2.** Density of Sm-doped PMN-PZ-0.352PT ceramic at different sintering temperatures

<table>
<thead>
<tr>
<th>Sintered temperature (°C)</th>
<th>1220</th>
<th>1240</th>
<th>1250</th>
<th>1270</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density (g/cm$^3$)</td>
<td>7.71</td>
<td>7.76</td>
<td>7.79</td>
<td>7.65</td>
</tr>
</tbody>
</table>