Electronic Supporting Information

Tunable CsPbBr$_3$/Cs$_4$PbBr$_6$ Phase Transformation and Their Optical Spectroscopy

Xiao Chen$^1$, Daqin Chen$^{1,2,*}$, Junni Li$^1$, Gaoliang Fang$^1$, Hongchao Sheng$^3$, Jiasong Zhong$^1$

$^1$College of Materials & Environmental Engineering, Hangzhou Dianzi University, Hangzhou, Zhejiang, 310018, P. R. China

$^2$College of Physics and Energy, Fujian Normal University, Fuzhou, Fujian, 350117, P. R. China

$^3$Department of Materials Science and Engineering, Jiangsu University of Science and Technology, Zhenjiang, Jiangsu, 212003, P. R. China

*Corresponding author, E-Mail: dqchen@hdu.edu.cn
Fax: (+ 86)-0571-87713538
Table S1 The evaluated lifetime values of CsPbX$_3$ and C$_4$PbX$_6$ products with different halogen ratios.

<table>
<thead>
<tr>
<th>sample</th>
<th>lifetime (ns)</th>
<th>Br:Cl=2:1</th>
<th>Br</th>
<th>Br:I=1:2</th>
<th>Br:I=2:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>CsPbX$_3$</td>
<td>4.6</td>
<td>6.9</td>
<td>14.6</td>
<td>29.3</td>
<td></td>
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<tr>
<td>C$_4$PbX$_6$</td>
<td>10.4</td>
<td>13.0</td>
<td>20.2</td>
<td>32.6</td>
<td></td>
</tr>
</tbody>
</table>
Figure S1 Quantitative excitation and emission spectra ($\lambda_{ex}=375$ nm) of (a) CsPbBr$_3$ sample and (b) Cs$_4$PbBr$_6$ one recorded by a spectrofluorometer equipped with an integrating sphere for quantum yield (QY) measurement.
Figure S2 (a) PL/Absorption spectra and (b) time-resolved fluorescence decay curves of the synthesized products obtained by using different amounts of OA and OM surfactants, transforming from 3D perovskite CsPbBr$_3$ to 0D perovskite-related Cs$_4$PbBr$_6$. 
Figure S3 Temperature-dependent emission spectra of Cs$_4$PbBr$_6$ product.
Figure S4 (a) XRD patterns, (b) PL/Absorption spectra and (c) time-resolved fluorescence decay curves of the synthesized products obtained by using different amounts of OA and OM surfactants, transforming from 3D perovskite CsPb(Br/Cl)$_3$ to 0D perovskite-related Cs$_4$Pb(Br/Cl)$_6$ with Br/Cl ratio of 2:1.
Figure S5 FTIR spectra of the as-prepared CsPbBr$_3$ and Cs$_4$PbBr$_6$ samples, showing the presence of COOH and NH$_2$ groups on the surfaces of CsPbBr$_3$ and Cs$_4$PbBr$_6$ particles.
Figure S6 A typical fluorescence image of CsPbBr$_3$ particles.