Electronic Supplementary Information (ESI)

Electronic and optical properties of a novel fluoroaluminate red phosphor Cs$_2$NaAl$_3$F$_{12}$:Mn$^{4+}$ with high color purity for white light-emitting diodes

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Figure S1. The corresponding selected area for EDS measurement from Cs$_2$NaAl$_3$F$_{12}$:2.33%Mn$^{4+}$ product.

Figure S2. TG curve of the prepared Cs$_2$NaAl$_3$F$_{12}$:2.33%Mn$^{4+}$ product.
**Figure S3.** CIE chromaticity diagram for the WLEDs made of (c) YAG and (d) YAG-Cs$_2$NaAl$_3$F$_{12}$:2.33%Mn$^{4+}$ mixture on GaN chip.

**Table S1.** Performance of the GaN-based WLEDs fabricated from (c) YAG and (d) YAG-Cs$_2$NaAl$_3$F$_{12}$:2.33%Mn$^{4+}$ mixture at 20 mA drive current.

<table>
<thead>
<tr>
<th>No. of devices</th>
<th>CIE (x, y)</th>
<th>CCT (K)</th>
<th>CRI (K)</th>
<th>LE (lm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>0.3172, 0.3470</td>
<td>6177</td>
<td>77.3</td>
<td>176.11</td>
</tr>
<tr>
<td>d</td>
<td>0.3947, 0.4066</td>
<td>3856</td>
<td>88.7</td>
<td>78.91</td>
</tr>
</tbody>
</table>