Supplementary Information

Engineering of metal-free bipyridine-based bridged silsesquioxanes for sustainable solid-state lighting

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Table and Figure captions

Table S1. Elemental composition (in %w) and calculated molar ratios for M5 and M6. The values indicated in parentheses indicate the theoretical ratio. The experimental errors are ±0.3% (absolute) for nitrogen and ±2% (relative error) for silicon.

Figure S1. FTIR spectra of M5 and M6.

Figure S2. $^{29}$Si solid-state CP-MAS NMR spectra of M5 and M6. The dotted line represents the fit using Gaussian functions in green solid lines.

Figure S3. $^{13}$C CP-MAS solid-state NMR spectra of M5 and M6 and $^{13}$C NMR of P5 and P6 in solution (DMSO-d$_6$). The asterisk and the paragraph symbol ($) correspond to the solvent (DMSO) and the carbon atoms of residual ethoxy groups, respectively.

Figure S4. XRD patterns of M5 and M6.

Figure S5. Thermogravimetric analysis of M6.

Figure S6. Excitation spectra of (a) M6 and (b) M5 monitored at 430 nm, 460 nm, 480/490 nm and 520 nm.
Table S1

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>%N</th>
<th>%Si</th>
<th>N/Si</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5</td>
<td>16.26</td>
<td>11.62</td>
<td>2.8 (3.0)</td>
</tr>
<tr>
<td>M6</td>
<td>16.92</td>
<td>10.92</td>
<td>3.1 (3.0)</td>
</tr>
</tbody>
</table>
Figure S1

![Graph showing T vs Wavenumber (cm⁻¹) with curves for M5 and M6]
Figure S2

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Figure S3

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Figure S4

The graph shows the intensity (arb. units) as a function of the scattering vector $q$ (nm$^{-1}$) for samples M5 and M6. The intensity peaks at different values of $q$, indicating the presence of distinct structural features in these materials.
Figure S5

[Graph showing weight and derivative weight vs. temperature]