Supporting Information

Improving Energy Relay Dyes for Dye-Sensitized Solar Cells by Use of a Group of Uniform Materials Based on Organic Salts (GUMBOS)

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Table S1. Melting point of GUMBOS.

<table>
<thead>
<tr>
<th>GUMBOS</th>
<th>Melting Point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[RhB][NTf2]</td>
<td>91</td>
</tr>
<tr>
<td>[RhB][BETI]</td>
<td>88</td>
</tr>
<tr>
<td>[TC1][NTf2]</td>
<td>235</td>
</tr>
<tr>
<td>[TC1][BETI]</td>
<td>215</td>
</tr>
<tr>
<td>[TC1][TPB]</td>
<td>231</td>
</tr>
<tr>
<td>[PC][NTf2]</td>
<td>248</td>
</tr>
<tr>
<td>[PC][BETI]</td>
<td>247</td>
</tr>
<tr>
<td>[P66614]4[TCPP]</td>
<td>128</td>
</tr>
</tbody>
</table>
Figure S1. Formation of Rhodamine B (RhB)-based GUMBOS.

Figure S2. Formation of 3,3′-diethylthiacarbocyanine (TC1)-based GUMBOS.
Figure S3. Formation of 1,1’-diethyl-2,2’-carbocyanine iodide (PC)-based GUMBOS.

Figure S4. Formation of meso-tetra(4-carboxyphenyl) porphine (TCPP)-based GUMBOS.
Figure S5: Normalized fluorescence intensity of parent dyes (A) [RhB][Cl], (B) [RhB][NTf₂], and (C) [RhB][BETI] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.
Figure S6: Normalized fluorescence intensity of parent dyes (A) [TC1][I], (B) [TC1][NTf2], (C) [TC1][BETI], and (D) [TC1][TPB] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.
Figure S7: Normalized fluorescence intensity of parent dyes (A) [PC][I], (B) [PC][NTf2], and (C) [PC][BETI] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.
Figure S8: Normalized fluorescence intensity of parent dyes (A) [H]₄[TCPP] and (B) [P66614]₄[TCPP] in the absence and presence of N719 (acceptor). Spectra for each dye were normalized by setting the highest intensity in the absence of N719 to a value of 1.

Figure S9: Fluorescence intensity (left) of [P66614]₄[TCPP] in the absence and presence of N719 (acceptor). Concentration of [P66614]₄[TCPP] was held at 10 μM. Stern-Volmer plot (right) of [P66614]₄[TCPP] in the absence and presence of N719 (acceptor). I₀, I, and [N719] represent the initial fluorescence intensity, fluorescence intensity, and concentration of N719.
Figure S10: Energy levels of parent dyes, titanium dioxide, and I$_3$/I$. The highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy levels are acquired from electrochemical measurements and band gap was determined from absorption onset wavelength.

**Electrochemical data was taken from the following papers:**


