**Fine Tuning of Molecular Rotor Function in Photochemical Molecular Switches**

**Supplementary Information**

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**Mixing Times**

Mixing Times - $t_{\text{mix}}$ (s) - used for the rotor cis-1 (S,S) at various temperatures

<table>
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Mixing Times - $t_{\text{mix}}$ (s) - used for the rotor trans-1 (S,S) at various temperatures

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Mixing Times - $t_{\text{mix}}$ (s) - used for the rotor cis-2 (C,S) at various temperatures

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Mixing Times - $t_{\text{mix}}$ (s) - used for the rotor trans-2 (C,S) at various temperatures

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Mixing Times - $t_{mix}$ (s) - used for the rotor cis-3 (O,S) at various temperatures

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Mixing Times - $t_{mix}$ (s) - used for the rotor trans-3 (O,S) at various temperatures

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Mixing Times - $t_{mix}$ (s) - used for the rotor cis-4 (S,O) at various temperatures

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Mixing Times - $t_{mix}$ (s) - used for the rotor cis-6 (O,O) at various temperatures

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Mixing Times - $t_{\text{mix}}$ (s) - used for the rotor trans-6 (O,O) at various temperatures

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Rate Constants of the Rotation

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<th>cis-1 (S,S)</th>
<th>trans-1 (S,S)</th>
<th>cis-2 (C,S)</th>
<th>trans-2 (C,S)</th>
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<td>$k$ (s$^{-1}$)</td>
<td>$k$ (s$^{-1}$)</td>
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<td>4.4 ± 0.3·10$^{-2}$</td>
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<td>1.28 ± 0.04·10$^{-1}$</td>
<td>4.6 ± 0.1·10$^{-2}$</td>
<td>1.11 ± 0.02·10$^{-1}$</td>
<td>7.8 ± 0.2·10$^{-2}$</td>
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<td>45ºC</td>
<td>2.93 ± 0.04·10$^{-1}$</td>
<td>1.09 ± 0.05·10$^{-1}$</td>
<td>2.63 ± 0.06·10$^{-1}$</td>
<td>1.65 ± 0.05·10$^{-1}$</td>
</tr>
<tr>
<td>55ºC</td>
<td>6.58 ± 0.08·10$^{-1}$</td>
<td>2.49 ± 0.09·10$^{-1}$</td>
<td>5.94 ± 0.07·10$^{-1}$</td>
<td>3.74 ± 0.07·10$^{-1}$</td>
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<td>1.01 ± 0.01·10$^{-1}$</td>
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<td>2.26 ± 0.04·10$^{-1}$</td>
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<td>7.61 ± 0.09·10$^{-1}$</td>
<td>5.0 ± 0.7·10$^{-1}$</td>
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Eyring Plots

Eyring plot for the \textit{cis-SS-1} rotor:

\begin{figure}
\centering
\includegraphics[width=\textwidth]{eyring_cis}
\end{figure}

Eyring plot for the \textit{trans-SS-1} rotor:

\begin{figure}
\centering
\includegraphics[width=\textwidth]{eyring_trans}
\end{figure}
Eyring plot for the cis-CS-2 rotor:

Eyring plot for the trans-CS-2 rotor:
\[
\ln\left(\frac{k h}{k_B T}\right) = \frac{1}{T} - k_f
\]
Eyring plot for the cis-OS-3 rotor:

Eyring plot for the trans-OS-3 rotor:
Eyring plot for the \textit{cis-SO$_4$} rotor:

\begin{center}
\begin{tikzpicture}
\begin{axis}[
    width=\textwidth,
    height=0.5\textwidth,
    xlabel={$1 / T (K^{-1})$},
    ylabel={$\ln \left( \frac{k h}{k_B T} \right)$},
    xmin=0.0030, xmax=0.0034,
    ymin=-32.5, ymax=-29.5
]
\addplot[black, only marks] table [x index=0, y index=1] {data.txt};
\end{axis}
\end{tikzpicture}
\end{center}

Eyring plot for the \textit{cis-CO$_5$} rotor:

\begin{center}
\begin{tikzpicture}
\begin{axis}[
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    height=0.5\textwidth,
    xlabel={$1 / T (K^{-1})$},
    ylabel={$\ln \left( \frac{k h}{k_B T} \right)$},
    xmin=0.0030, xmax=0.0034,
    ymin=-32.5, ymax=-29.5
]
\addplot[black, only marks] table [x index=0, y index=1] {data.txt};
\end{axis}
\end{tikzpicture}
\end{center}
Eyring plot for the \textit{cis-OO-6} rotor:

\begin{figure}
\centering
\includegraphics[width=\textwidth]{cis_eyring_plot}
\end{figure}

Eyring plot for the \textit{trans-OO-6} rotor:

\begin{figure}
\centering
\includegraphics[width=\textwidth]{trans_eyring_plot}
\end{figure}