Isotopic substitution of imidazolium-based ionic liquids

\[ H_2O + D_2O \rightleftharpoons 2HOD \]

Instantaneous $\sim$ ps

So slow Why?
Properties of Water Confined in Ionic Liquids

Koji Saihara, Yukihiro Yoshimura, Soichi Ohta & Akio Shimizu
Separated $^1$H peak of Shielded water / Deshields water
→ Abnormally slow proton exchange
→ Water-Pocket
<table>
<thead>
<tr>
<th></th>
<th>Self-diffusion coefficient (m²/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂O for 1:1 H₂O:D₂O</td>
<td>2.25 x 10⁻⁹</td>
</tr>
<tr>
<td>HOD for 1:1 H₂O:D₂O</td>
<td>2.11 x 10⁻⁹</td>
</tr>
<tr>
<td>H₂O for 1:0.5:0.5 [BMIM][BF₄]:H₂O:D₂O</td>
<td>4.39 x 10⁻¹⁰</td>
</tr>
<tr>
<td>HOD for 1:0.5:0.5 [BMIM][BF₄]:H₂O:D₂O</td>
<td>4.33 x 10⁻¹⁰</td>
</tr>
<tr>
<td>[BMIM]⁺ for 1:0.5:0.5 [BMIM][BF₄]:H₂O:D₂O</td>
<td>6.63 x 10⁻¹¹</td>
</tr>
<tr>
<td>[BF₄]⁻ for 1:0.5:0.5 [BMIM][BF₄]:H₂O:D₂O</td>
<td>7.08 x 10⁻¹¹</td>
</tr>
</tbody>
</table>
Nanoconfinement’s Dramatic Impact on Proton Exchange between Glucose and Water

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Seoncheol Cha
26 Nov 2016
Exchange Rate of Hydroxyl groups of Glucose aqueous solution: 2000 /s

α: $R_1 = H; R_2 = OH$
β: $R_1 = OH; R_2 = H$
Reverse Micelle (RM)

AOT (sodium bis(2-ethylhexyl) sulfosuccinate)

AOT/water
+ 10% cyclohexane-d$_{12}$/isoctane
First, the $90° - t - 90°$ sequence is used to generate frequency labelled $z$-magnetization. Then, during $\tau_{\text{mix}}$, this magnetization is allowed to migrate to other spins, carrying its label with it. Finally, the last pulse renders the $z$-magnetization observable.
Exchange Rate of glucose bulk: 2000 /s
Exchange Rate of glucose RM < 400 /s

\[
glucose\]

\[\alpha: R_1 = H; R_2 = OH\]
\[\beta: R_1 = OH; R_2 = H\]
\[
\text{HOH}^* + \text{GOH} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} \text{HOH} + \text{GOH}^* \rightarrow \text{HOH} + \text{GOH}
\]

\[
\text{HOH}^* + \text{GOH} \rightarrow \text{HOH} + \text{GOH}^* \rightarrow \text{HOH} + \text{GOH}
\]

\[
[\text{GOH}^*] = \frac{k_1}{k_2 - k_1} [\text{GOH}]_0 (e^{-k_1t} - e^{-k_2t}) + C
\]
$$[\text{GOH}^*] = \frac{k_1}{k_2 - k_1} [\text{GOH}]_0 (e^{-k_1t} - e^{-k_2t}) + C$$