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## Supporting Information

Shantz and Lobo

Figure 1S. Static ${ }^{2} H$ NMR spectra of (a) $d_{9}$-SSZ-23 and (b) $d_{12}$-ZSM-12, and (c) neat $d_{12^{-}}$ 4,4'-trimethylenebis( 1,1 '-dimethylpiperidinium) diiodide. One thousand scans were acquired for (a) and (c), and 10,000 scans were acquired for (b).

Figure $2 \mathrm{~S} .{ }^{2} \mathrm{H}-\left\{{ }^{1} \mathrm{H}\right\}$ MAS spectra of (a) $d_{9}$-TMC6 - NON and (b) $d_{9}$-SSZ-23. 64 scans were acquired for both spectra.

Figure 3S. (a) ${ }^{2} \mathrm{H}$ MAS spectra and $(\mathrm{b}, \mathrm{c}){ }^{2} \mathrm{H}-\left\{{ }^{1} \mathrm{H}\right\}$ CPMAS of $d_{9}$-TMC5 nonasil synthesized in $\mathrm{D}_{2} \mathrm{O}$. Contact times of $200 \mu \mathrm{~s}$ and $400 \mu \mathrm{~s}$ were used in (b) and (c) respectively.









