Supplemental Materials for: Activating Magnesium Electrolytes through Chemical Formation of Free Chloride and Removal of Trace Water

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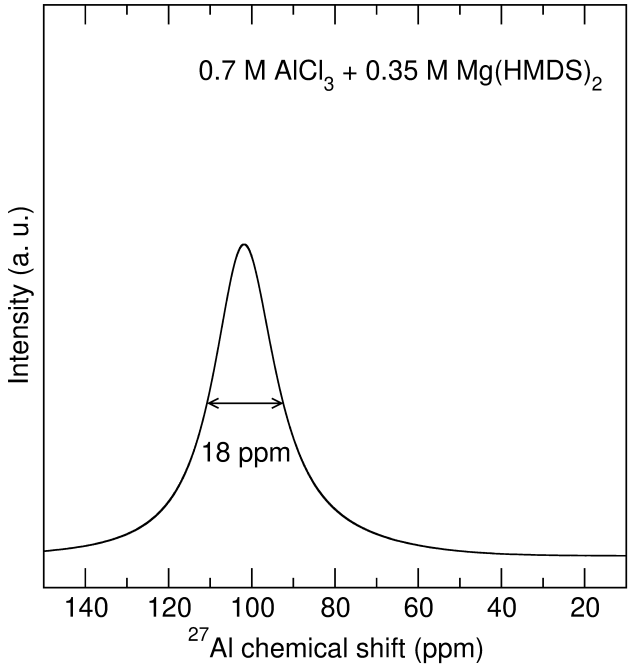

Figure S1: ^{27}Al NMR of 0.7 M $AlCl_3$ + 0.35 M $Mg(HMDS)_2$. Only one broad resonance is observed at 102 ppm with a full width at half maximum of 18 ppm.

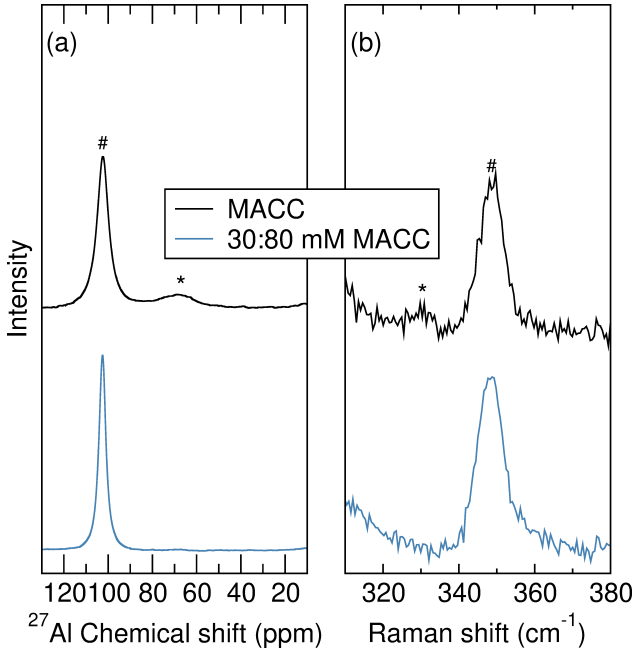

Figure S2: (a) ^{27}Al NMR and (b) Raman spectra of MACC and 30:80 mM MACC. The 66 ppm resonance present in MACC (*), which corresponds to $AlCl_3$, is not present in 30:80 mM MACC. Similarly, the Al–Cl mode of $AlCl_3$ at 328 cm^{-1} present in MACC (*) is not present in 30:80 mM MACC.

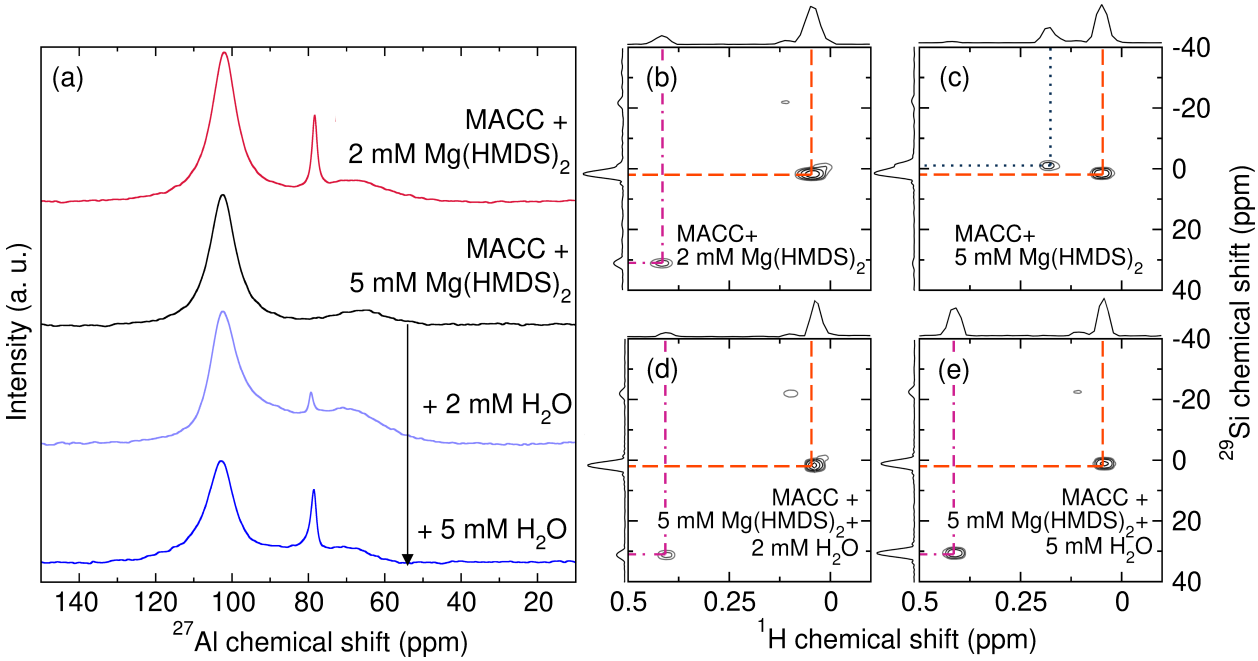

Figure S3: (a) ^{27}Al NMR spectra and ^{1}H–^{29}Si HMBC spectra of MACC (b) + 2 mM $Mg(HMDS)_2$, (c) + 5 mM $Mg(HMDS)_2$, (d) + 5 mM $Mg(HMDS)_2$ + 2 mM H_2O, (e) + 5 mM $Mg(HMDS)_2$ + 5 mM H_2O. The 78 ppm resonance in ^{27}Al NMR and the {0.415, 31} ppm cross peak in ^{1}H–^{29}Si HMBC are not present in MACC + 5 mM $Mg(HMDS)_2$, but appear in the presence of H_2O.

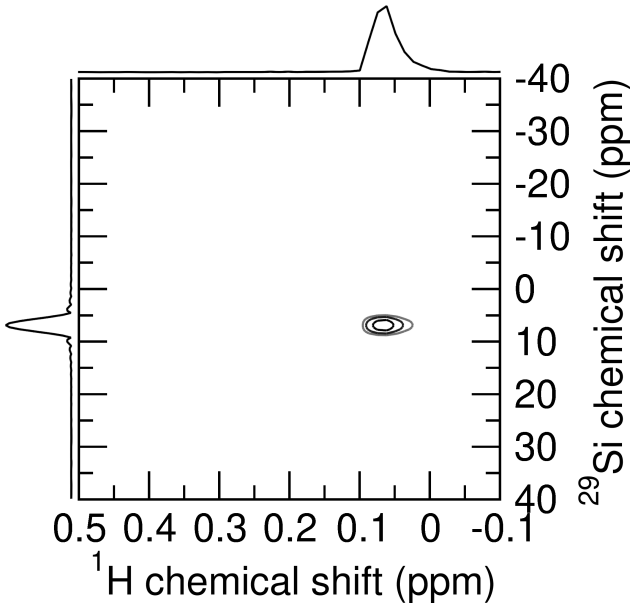

Figure S4: ^{1}H–^{29}Si HMBC spectrum of trimethylsilanol ($(CH_3)_3SiOH$), whose cross peak is located at {0.066, 7} ppm.

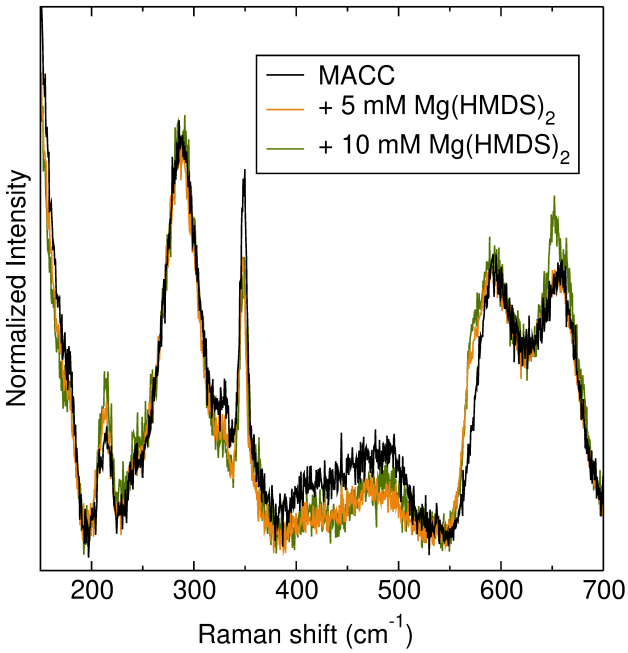

Figure S5: Raman spectra of as-prepared MACC, MACC + 5, and 10 mM $Mg(HMDS)_2$ overlayed on top of one another. These spectra are the same spectra as in Figure 1. All intensities are normalized to a THF mode at 913 cm^{-1}. With increasing $Mg(HMDS)_2$ concentration, the $[Mg_2(\mu{-}Cl)_3 \cdot 6\,(THF)]^+$ mode at 210 cm^{-1} increases while the $AlCl_4^-$ mode at 347 cm^{-1} decreases in intensity. Also, two new modes develop at 569 cm^{-1} and 651 cm^{-1}.