# Reversible electrodeposition and stripping of magnesium from solvate ionic liquid–tetrabutylammonium chloride mixtures

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*Electronic Supplementary Information (ESI)*

## Supplementary figures

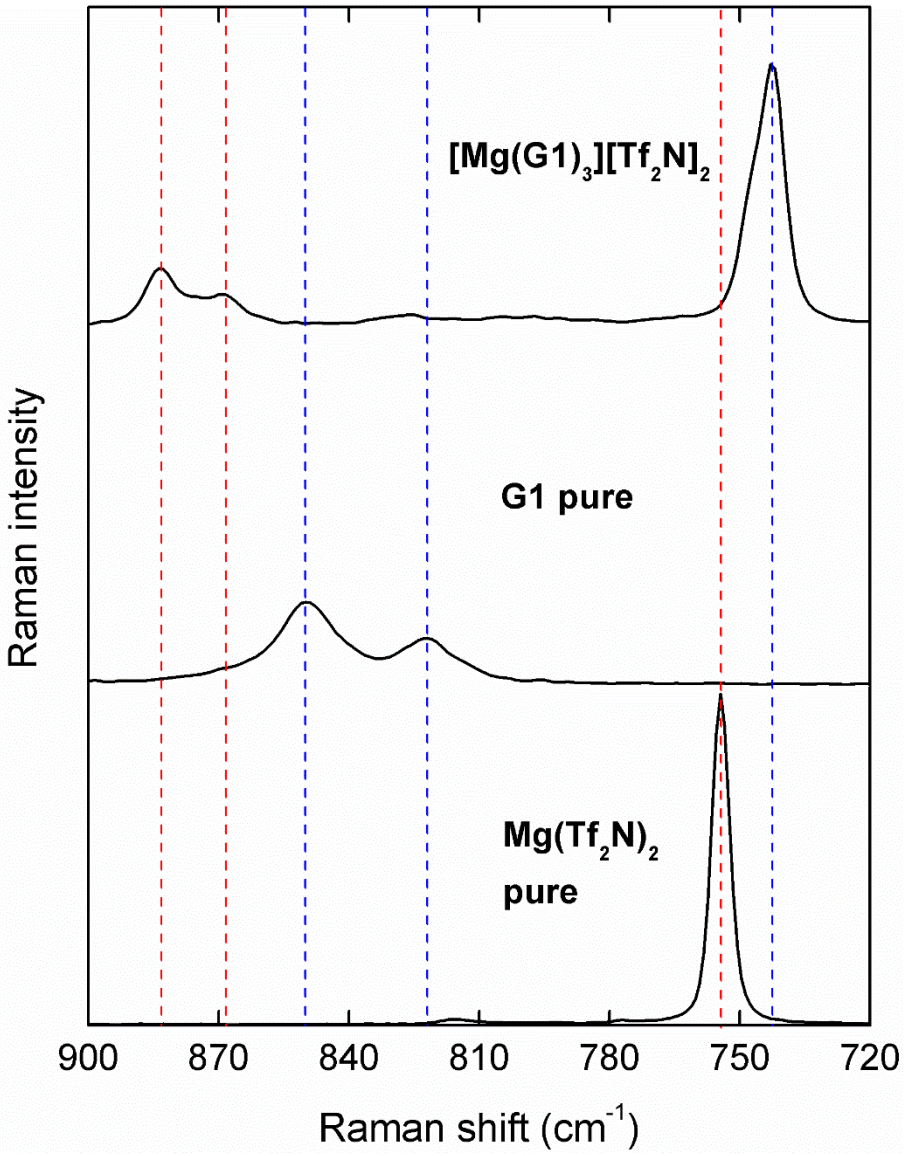


**Figure S1.** Raman spectra of $[Mg(G1)_3][Tf_2N]_2$ (top), pure G1 (middle), and $Mg(Tf_2N)_2$ (bottom) in the range from 900 $cm^{-1}$ to 720 $cm^{-1}$. The red and blue dashed lines are a visual aid to show the bands corresponding to coordinated and uncoordinated ligands/anions, respectively.

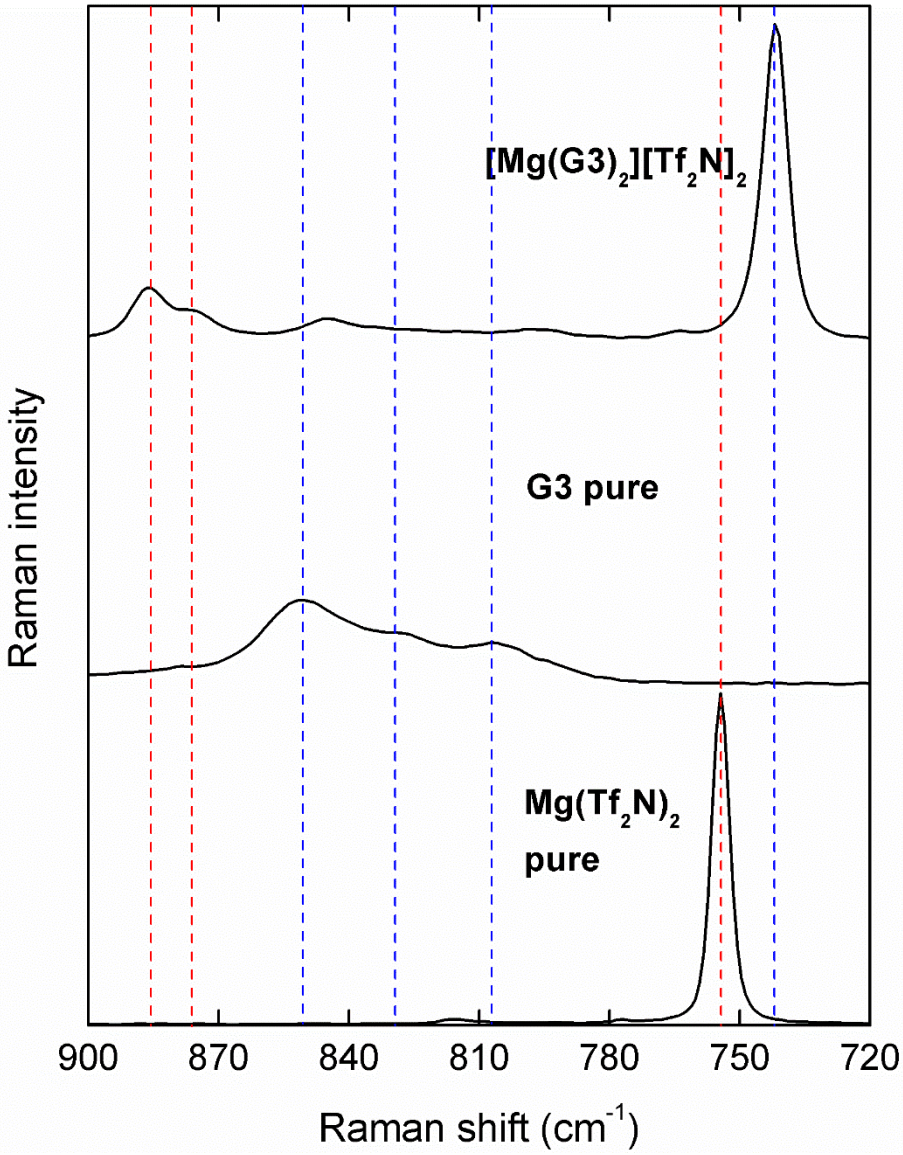


**Figure S2.** Raman spectra of $[Mg(G3)_2][Tf_2N]_2$ (top), pure G3 (middle), and $Mg(Tf_2N)_2$ (bottom) in the range from 900 $cm^{-1}$ to 720 $cm^{-1}$. The red and blue dashed lines are a visual aid to show the bands corresponding to coordinated and uncoordinated ligands/anions, respectively.

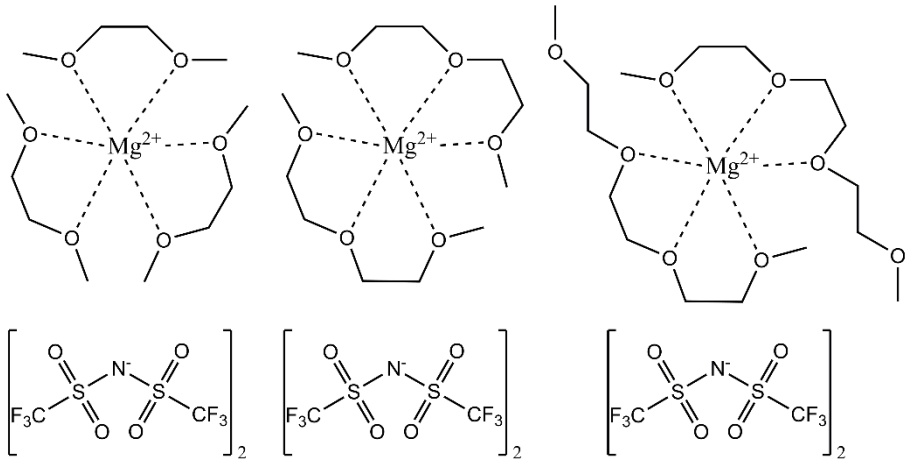

**Figure S3.** Schematic representation of the proposed solvent separated ion pair (SSIP) solvate structures of $[Mg(G1)_3][Tf_2N]_2$ (left), $[Mg(G2)_2][Tf_2N]_2$ (middle), and $[Mg(G3)_2][Tf_2N]_2$ (right).

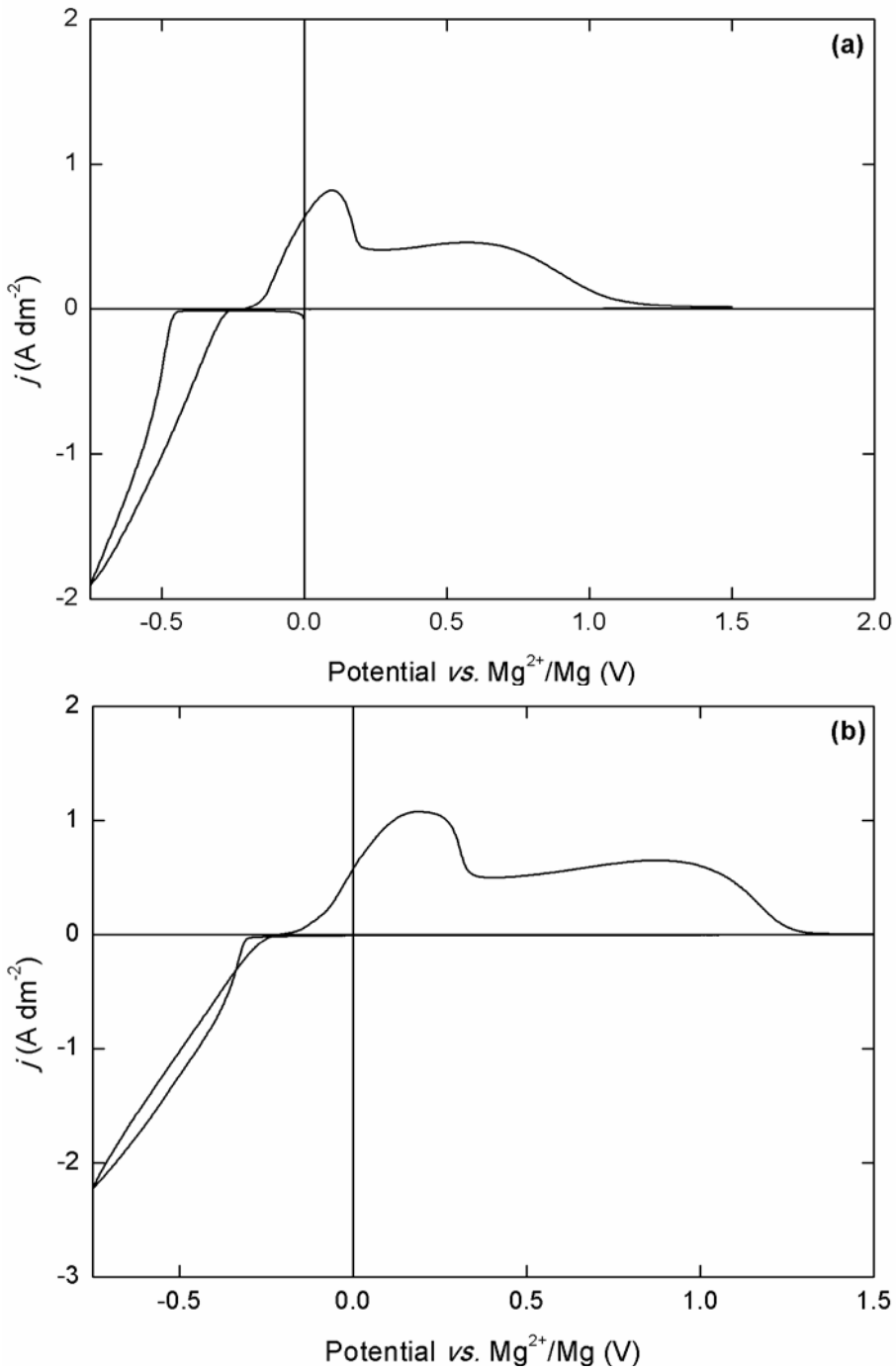


**Figure S4.** Cyclic voltammograms (first cycle) of $[Mg(G1)_3][Tf_2N]_2$:TBACl 1:1 (top), and $[Mg(G3)_2][Tf_2N]_2$:TBACl 1:1 (bottom), recorded on a platinum disk working electrode at 80 °C. The counter and reference electrode was magnesium and the scan rate was 50 mV $s^{-1}$. Due to the use of a magnesium pseudo-reference electrode, the potential is shifted to the negative side, as illustrated by the negative potential of the stripping peak onset.

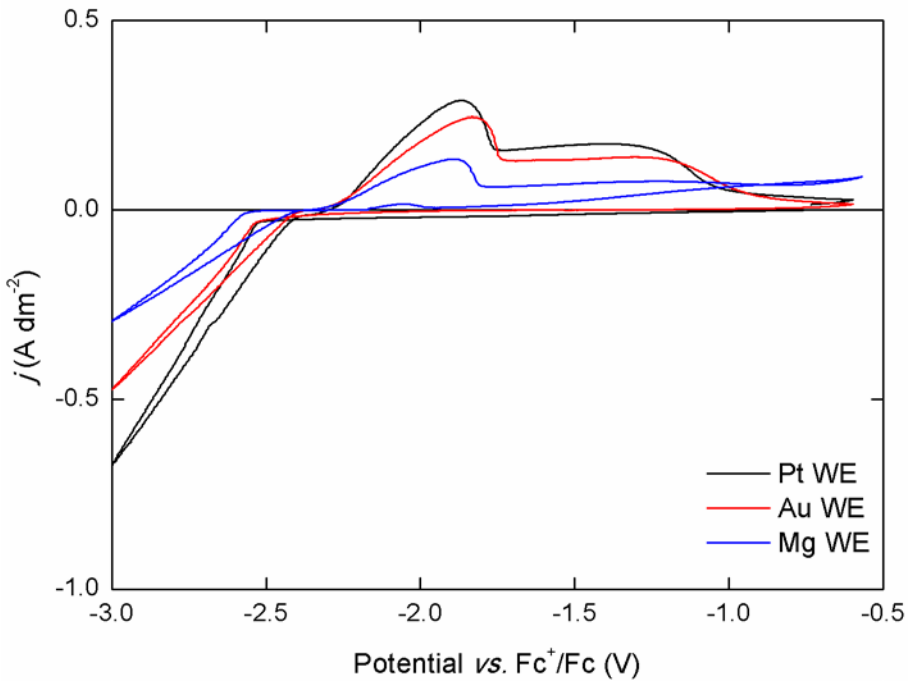


**Figure S5.** Cyclic voltammograms of $[Mg(G3)_2][Tf_2N]_2$:TBACl 1:1, recorded on a platinum-coated silicon wafer (black curve), a gold-coated silicon wafer (red curve) or magnesium metal strip (blue curve) at 80 °C. The reference electrode was $Fc^+/Fc$ in $[BMP][Tf_2N]$, the counter electrode was magnesium metal and the scan rate was 50 mV $s^{-1}$.

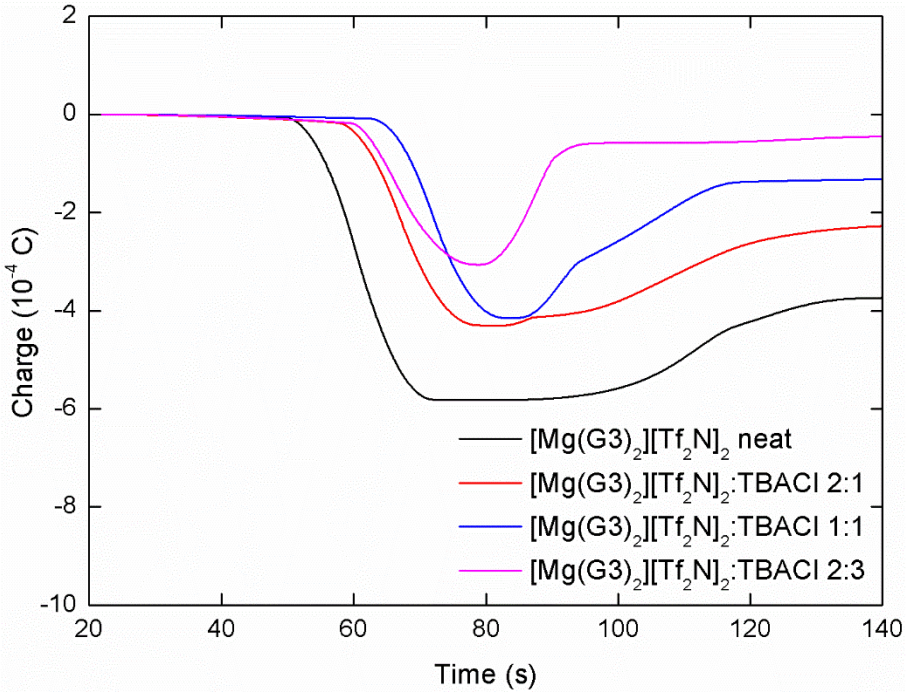


**Figure S6.** Charge *vs.* time plots accompanying cyclic voltammograms (first cycle) of [Mg(G3)$_2$][Tf$_2$N]$_2$:TBACl in various ratios, recorded on a platinum disk working electrode at 80 °C, as depicted in Figure 6a.

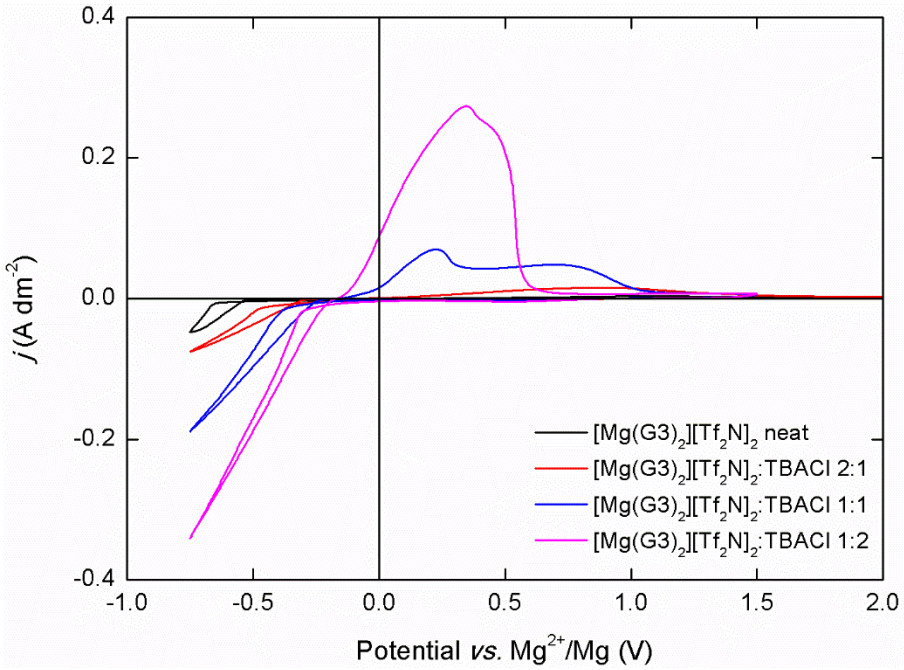


**Figure S7.** Cyclic voltammograms of $[Mg(G3)_2][Tf_2N]_2$:TBACl in various ratios, recorded on a platinum disk electrode. The pseudo-reference and counter electrodes were magnesium metal and the scan rate was 50 mV $s^{-1}$.