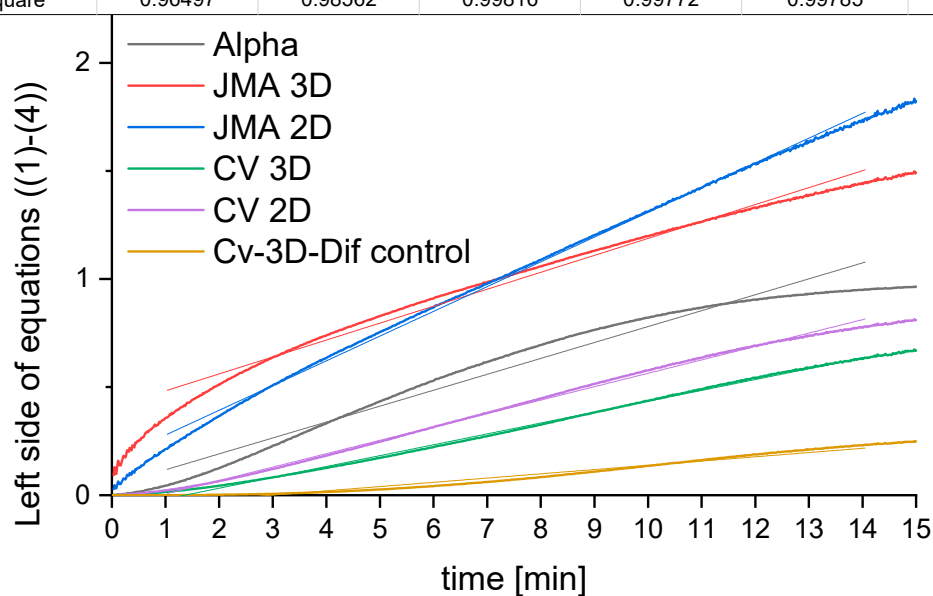


# Fast hydrogen sorption kinetics in Mg- $\text{VCl}_3$ produced by cryogenic ball-milling

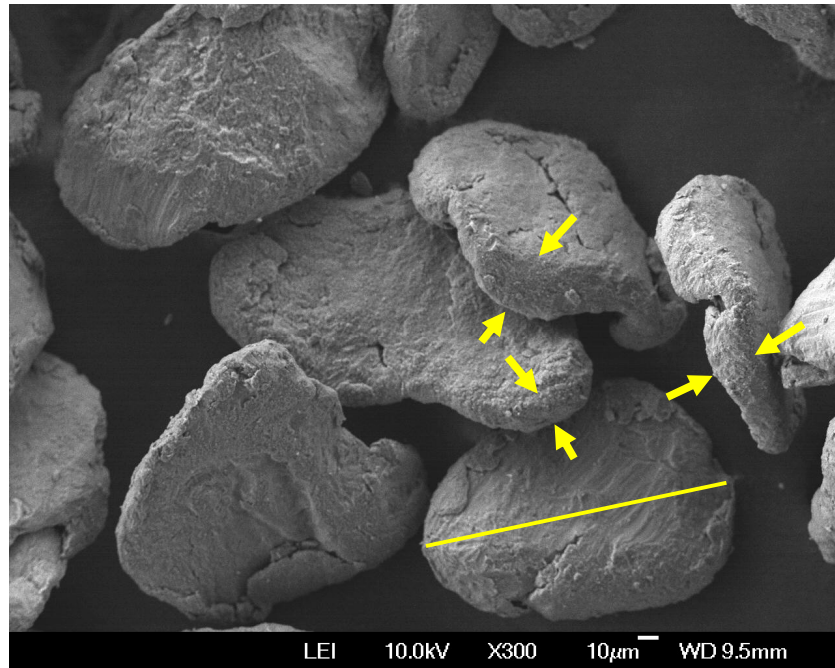
Karina Suárez-Alcántara<sup>1\*</sup>, Nadia Isabel Flores Jacobo<sup>1</sup>, Mayara del Pilar Osorio-García<sup>2</sup>, José Gerardo Cabañas-Moreno<sup>2</sup>

**Figure S1.** Application of the kinetic models to the dehydriding reaction at 350°C and 0.8 bar.

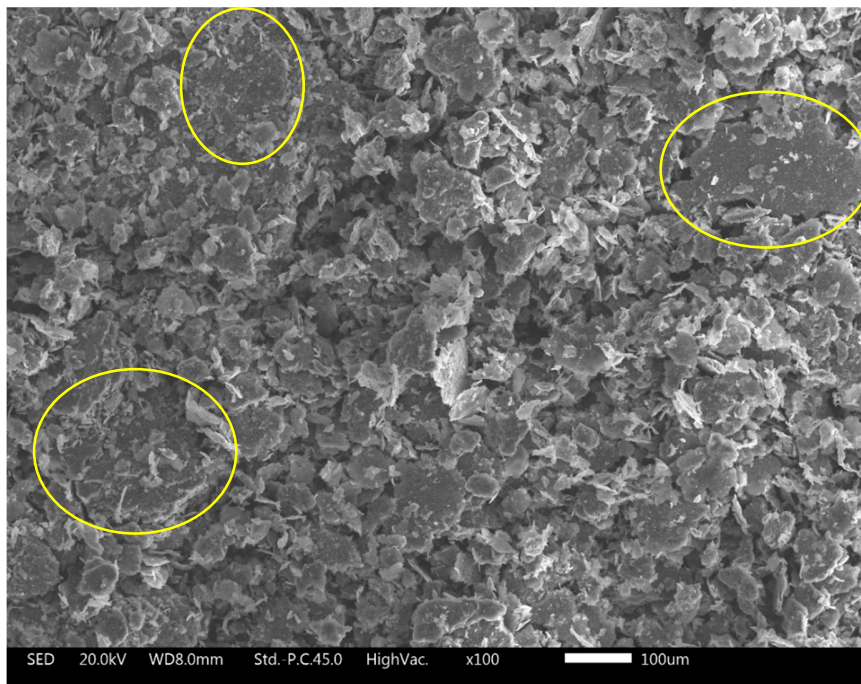
Equation	$y = a + b \cdot x$					
Plot	Alpha	JMA 3D	JMA 2D	CV 3D	CV 2D	Cv-3D-Dif contro
Weight	No Weighting					
Intercept	$0.04379 \pm 0.004$	$0.40431 \pm 0.002$	$0.16368 \pm 0.001$	$-0.0685 \pm 7.249$	$-0.05628 \pm 8.685$	$-0.05863 \pm 0.00$
Slope	$0.07362 \pm 5.018$	$0.07835 \pm 3.385$	$0.11446 \pm 1.759$	$0.05029 \pm 8.601$	$0.06202 \pm 1.030$	$0.01968 \pm 1.367$
Residual Sum of S	2.17496	0.98983	0.26721	0.06389	0.09169	0.16149
Pearson's r	0.98235	0.99279	0.99908	0.99886	0.99892	0.98168
R-Square (COD)	0.96502	0.98564	0.99816	0.99772	0.99785	0.9637
Adj. R-Square	0.96497	0.98562	0.99816	0.99772	0.99785	0.96365



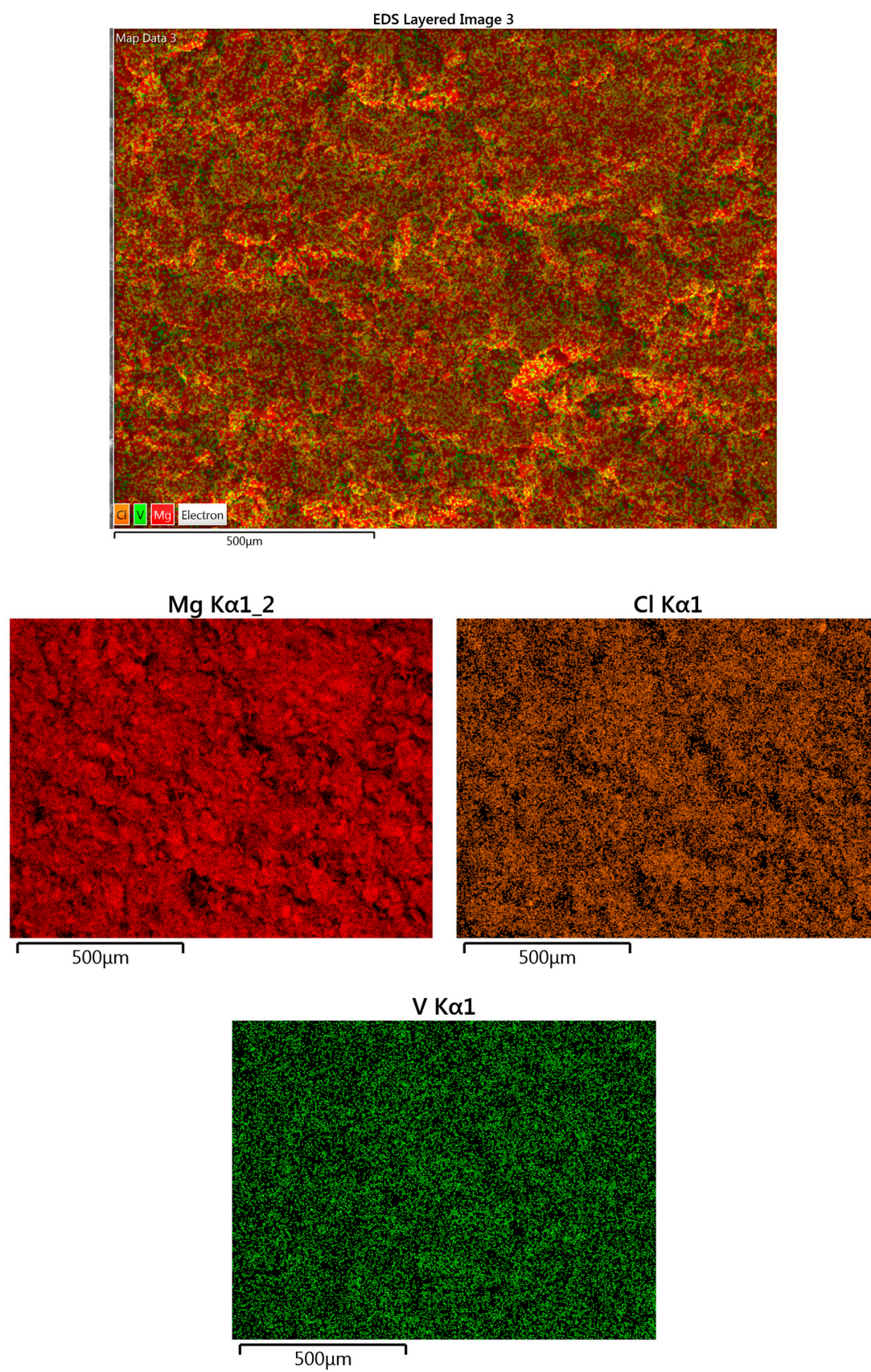
**Figure S2.** Scanning electron micrograph (SEM) of the as-received Mg powders.



**Figure S3.** Scanning electron micrograph (SEM) of cryogenically milled Mg-15wt%VCl<sub>3</sub>

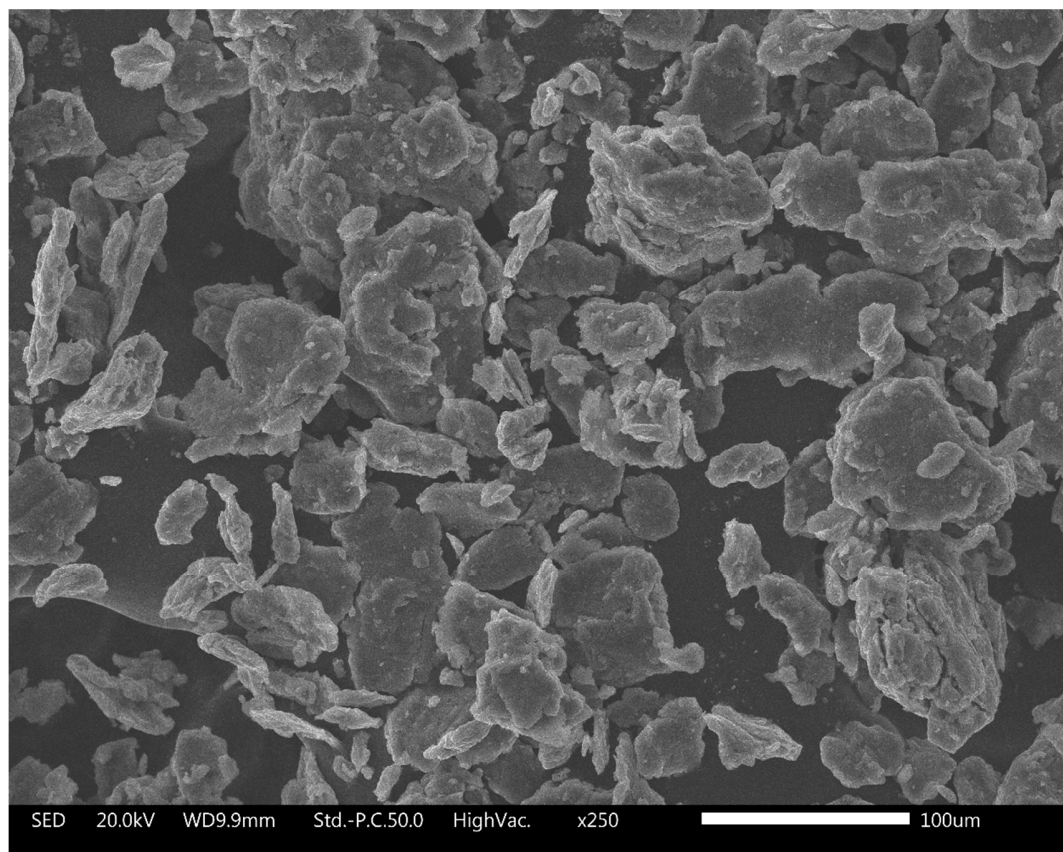


**Figure S4.** Elemental mapping of cryogenically milled Mg-15wt%VCl<sub>3</sub>.



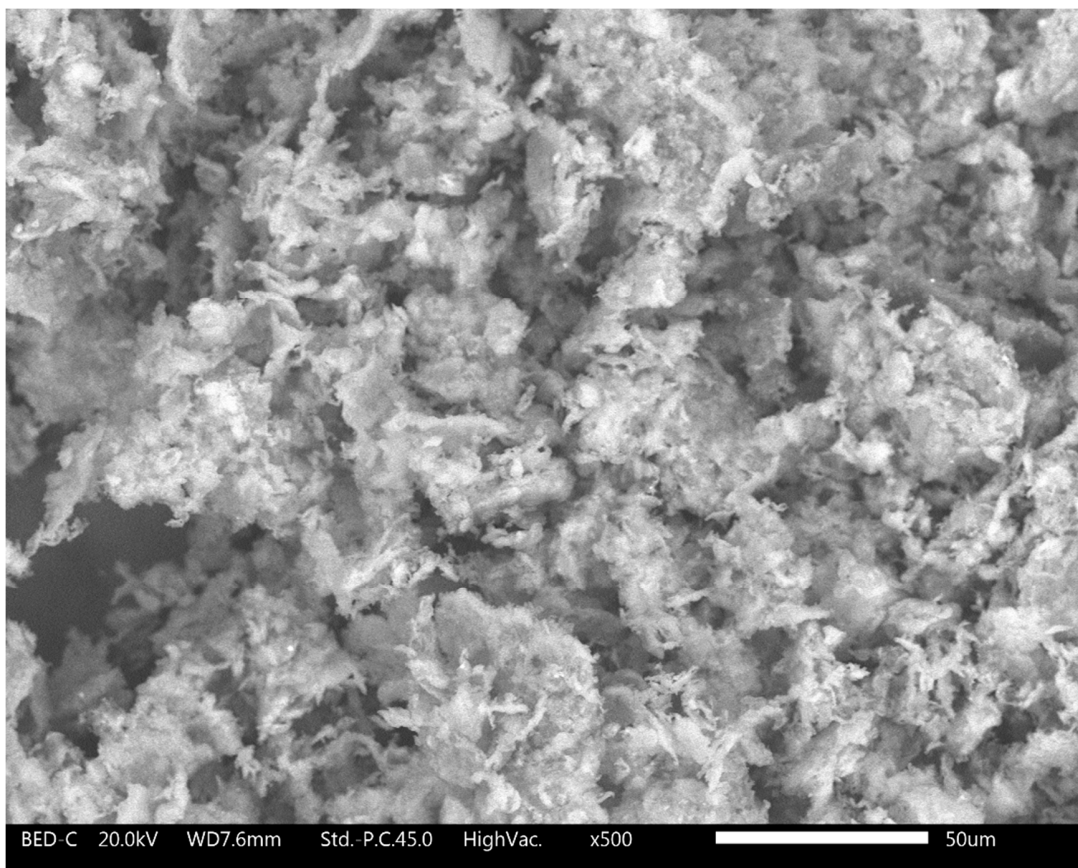
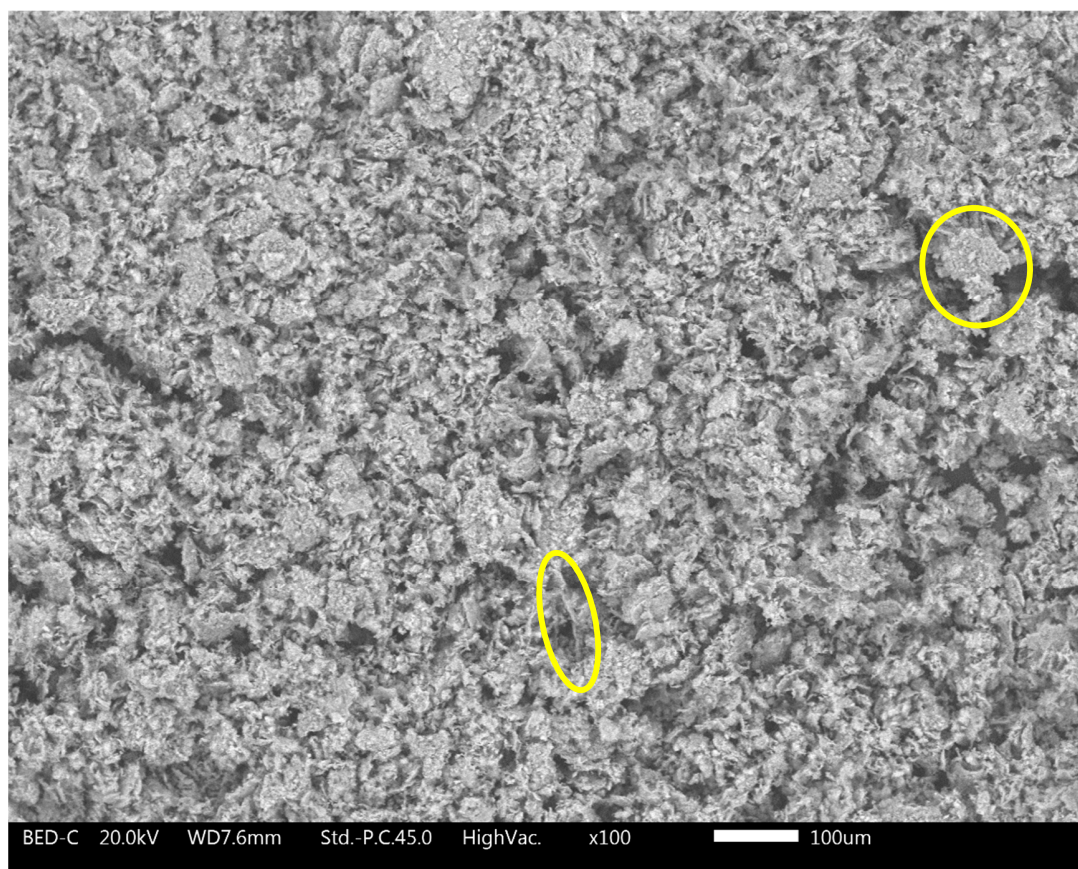


**Figure S5.** Scanning electron micrographs (SEM) of cryogenically milled Mg.



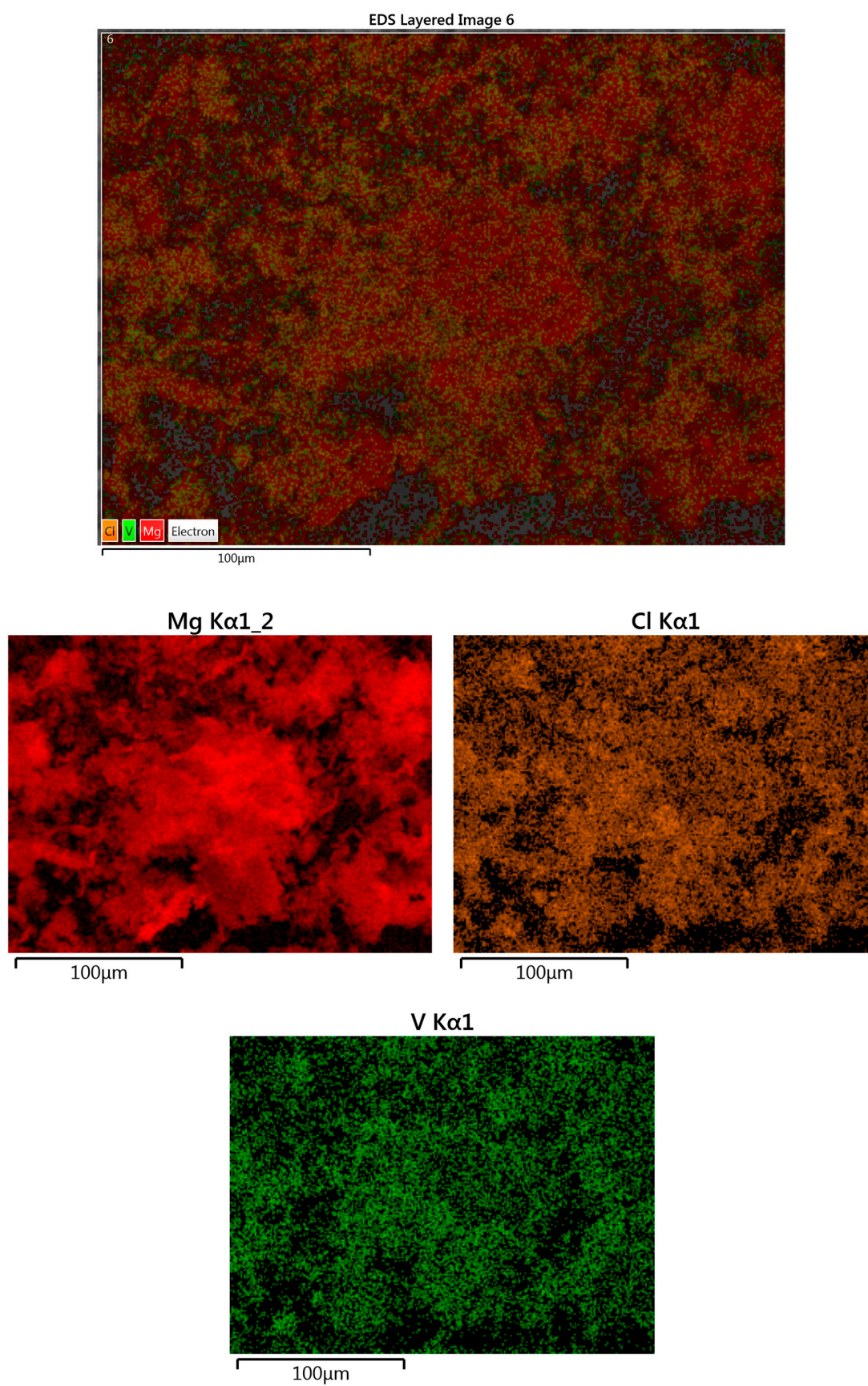


**Figure S6.** Scanning electron micrographs (SEM) of hydrided Mg-15wt%VCl<sub>3</sub>, 4<sup>th</sup> cycle at 350°C, 26 bar.

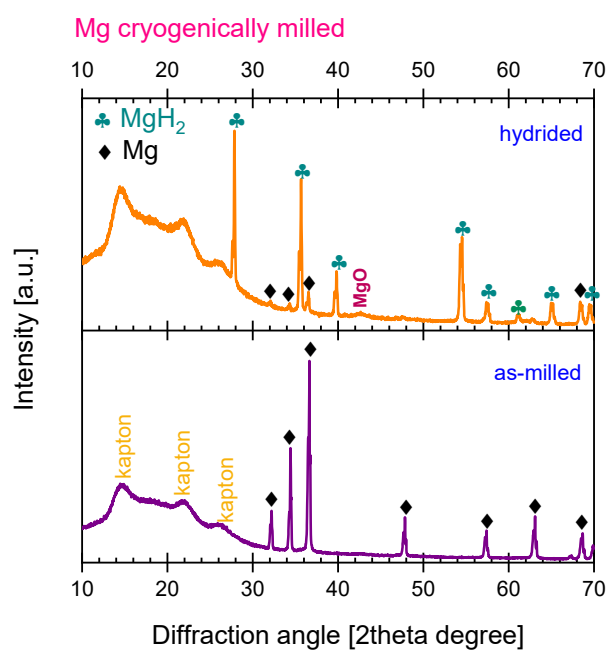




**Figure S7.** Elemental mapping of cycled (PCI-cycled) Mg-15wt%VCl<sub>3</sub>.



**Figure S8.** X-ray diffraction of cryogenically milled pure Mg and hydrided material at 350°C/ 26 bar.



**Figure S9.** X-ray diffraction and SEM of as-received VCl<sub>3</sub>.

