

Supporting Information for

High Capacity All-Solid-State Lithium Battery Enabled by *In Situ* Formation of Ionic Conduction Path by Lithiation of MgH₂

Atsushi Inoishi,^{*a} Hiroki Sato,^b Yixin Chen,^b Hikaru Saito,^a Ryo Sakamoto,^a Hikari Sakaebe^a and Shigeto Okada^a

^a Institute for Materials Chemistry and Engineering, Kyushu University

Kasuga-Koen 6-1, Kasuga-shi, Fukuoka 816-8580, Japan

E-mail: inoishi@cm.kyushu-u.ac.jp

^b Interdisciplinary Graduate School of Engineering Sciences, Kyushu University

Kasuga-Koen 6-1, Kasuga-shi, Fukuoka 816-8580, Japan

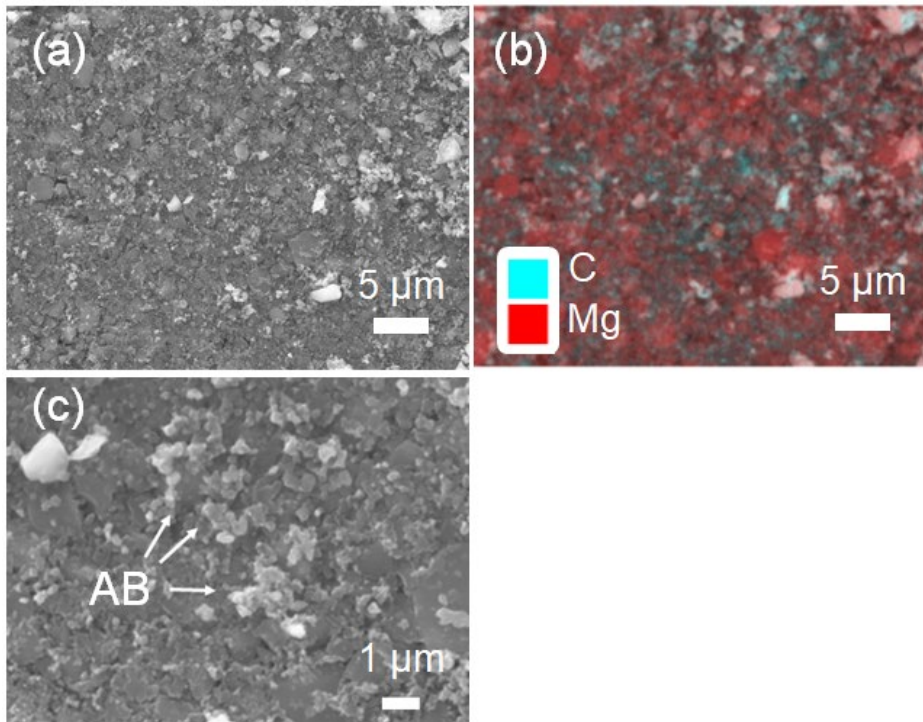


Figure S1. SEM images and EDS mapping results for electrode mixture pressed at 320 MPa. The electrode mixtures without LiBH_4 ($\text{MgH}_2:\text{AB} = 70:30$) were pressed at 320 MPa. SEM images (Fig. S1a) and an EDS map (Figs. S1b) are displayed. An SEM image at higher magnification (10,000×) is displayed in Fig. S1c.

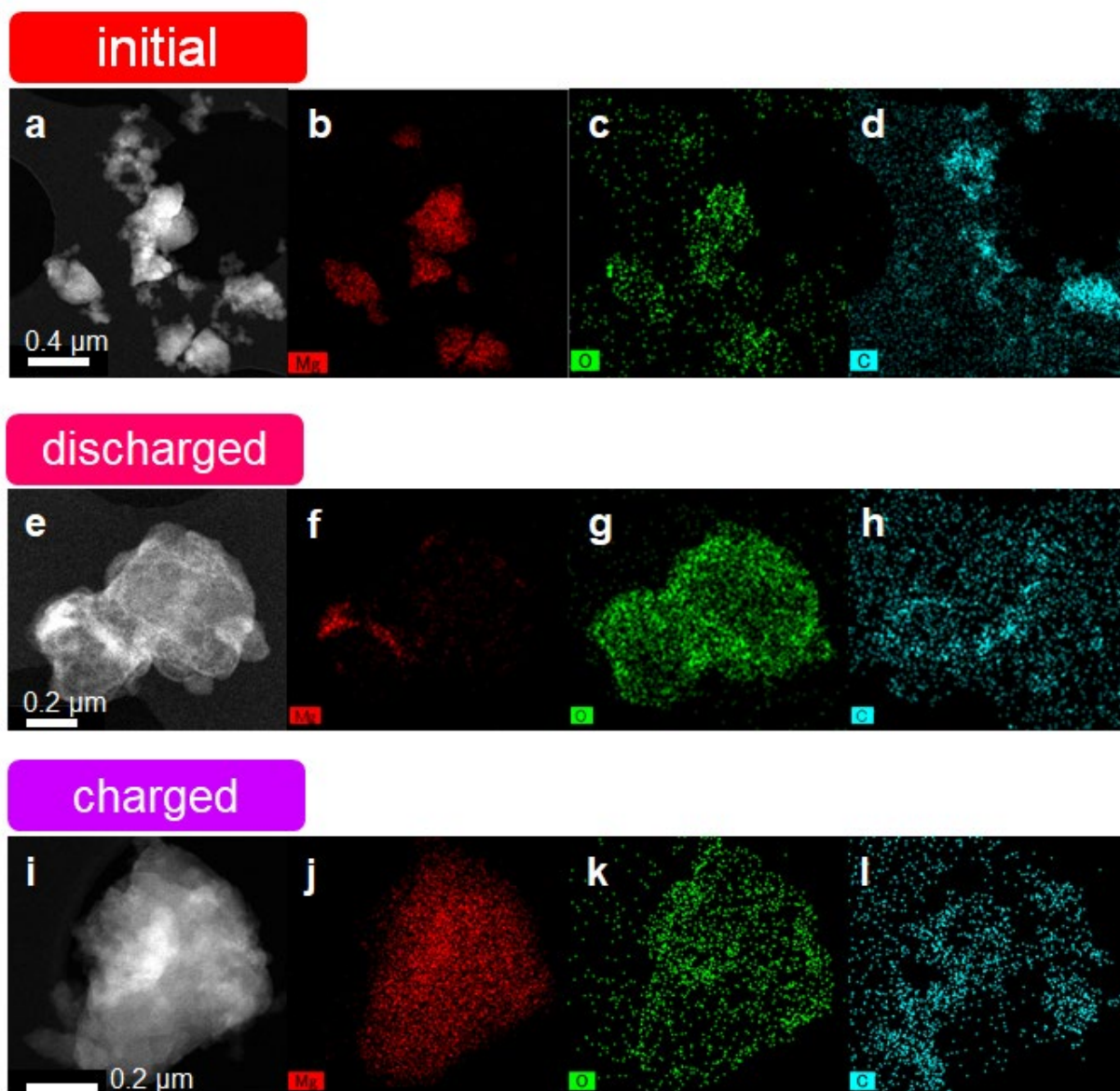


Figure S2. EDS analysis results for (a–d) initial MgH_2 and AB composite powders, (e–h) discharged state, and (i–l) charged state. For all the states, ADF-STEM images (Fig. S2a, S2e, and S2i), Mg maps (Figs. S2b, S3f, and S2j), O maps (Figs. S2c, S2g, and S2k), and C maps (Figs. S2d, S2h, and S2l) are displayed in this order.

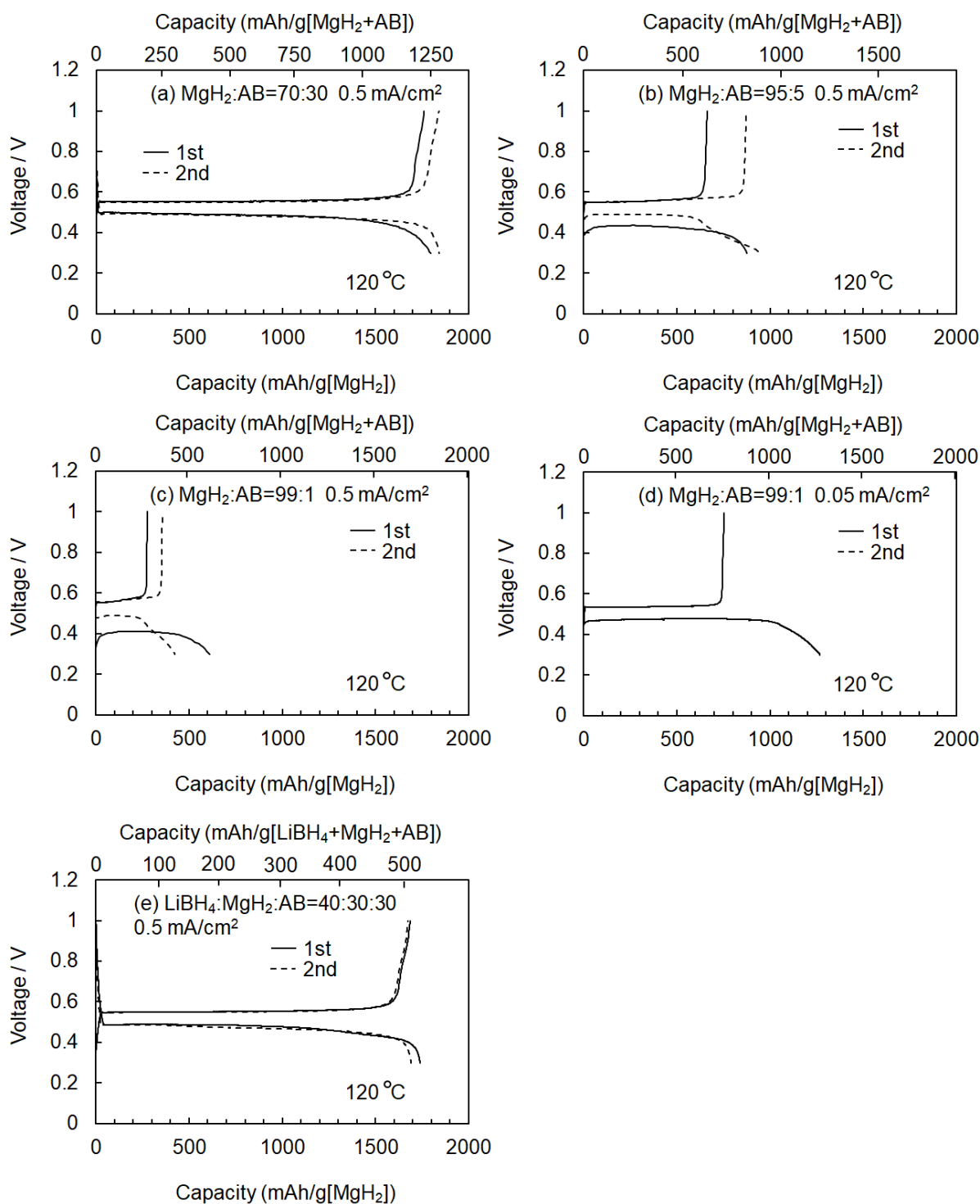


Figure S3. Discharge (lithiation)–charge (delithiation) curves for cells with different electrode compositions: (a) composition $\text{MgH}_2\text{:AB} = 70\text{:}30$, current density 0.5 mA/cm^2 ; (b) composition $\text{MgH}_2\text{:AB} = 95\text{:}5$, current density 0.5 mA/cm^2 ; (c) composition $\text{MgH}_2\text{:AB} = 99\text{:}1$, current density 0.5 mA/cm^2 ; (d) composition $\text{MgH}_2\text{:AB} = 99\text{:}1$, current density 0.05 mA/cm^2 ; and (e) composition $\text{LiBH}_4\text{:MgH}_2\text{:AB} = 40\text{:}30\text{:}30$, current density 0.5 mA/cm^2 .