

Supplementary information:

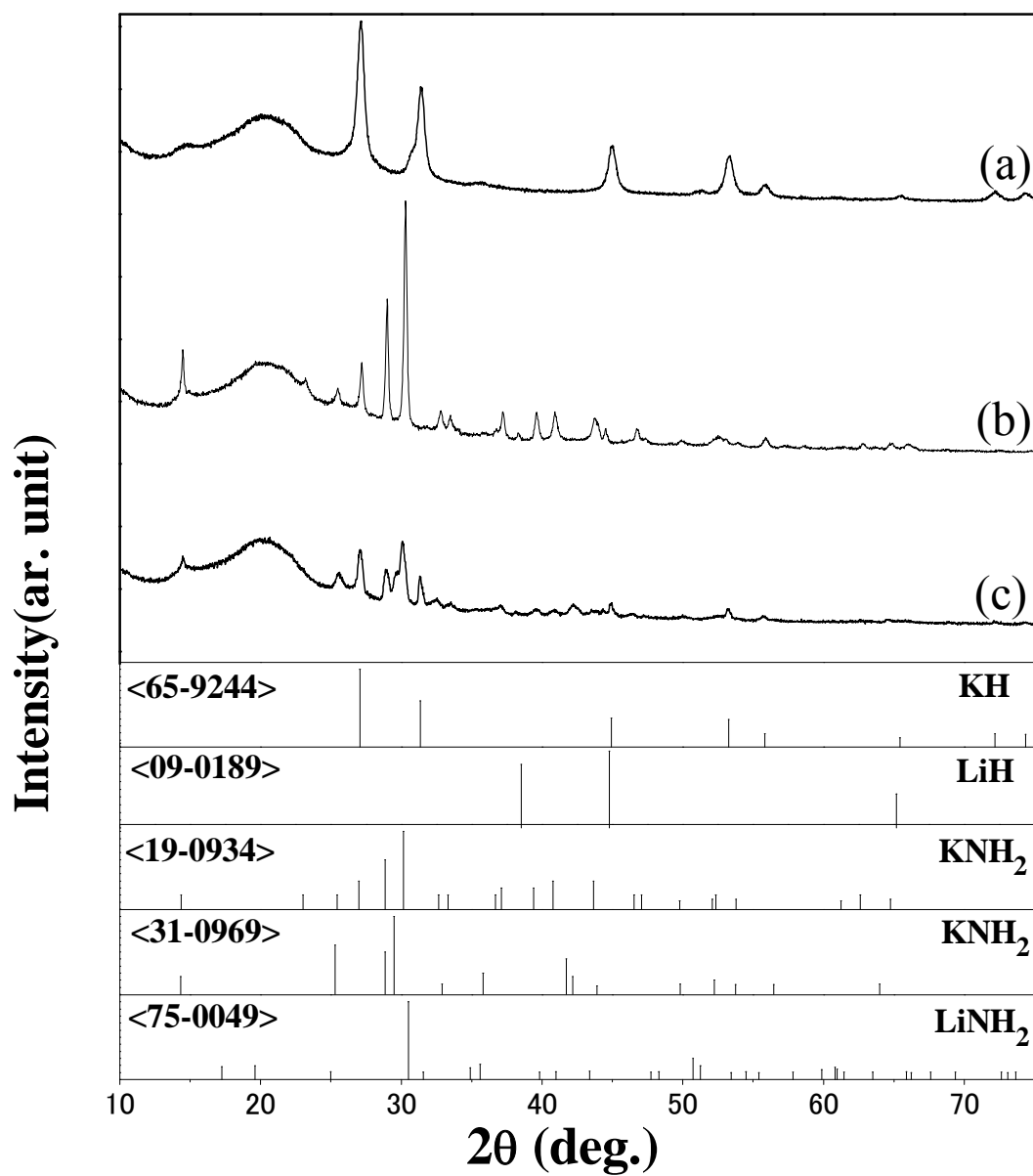


Fig. S1: XRD patterns of the ball-milled (a) or hand-milled (b) composite of LiH and  $\text{KNH}_2$  with 1/1 molar ratio and the products after the hand-milled composite is heated at 100 °C for 60 minutes (c).

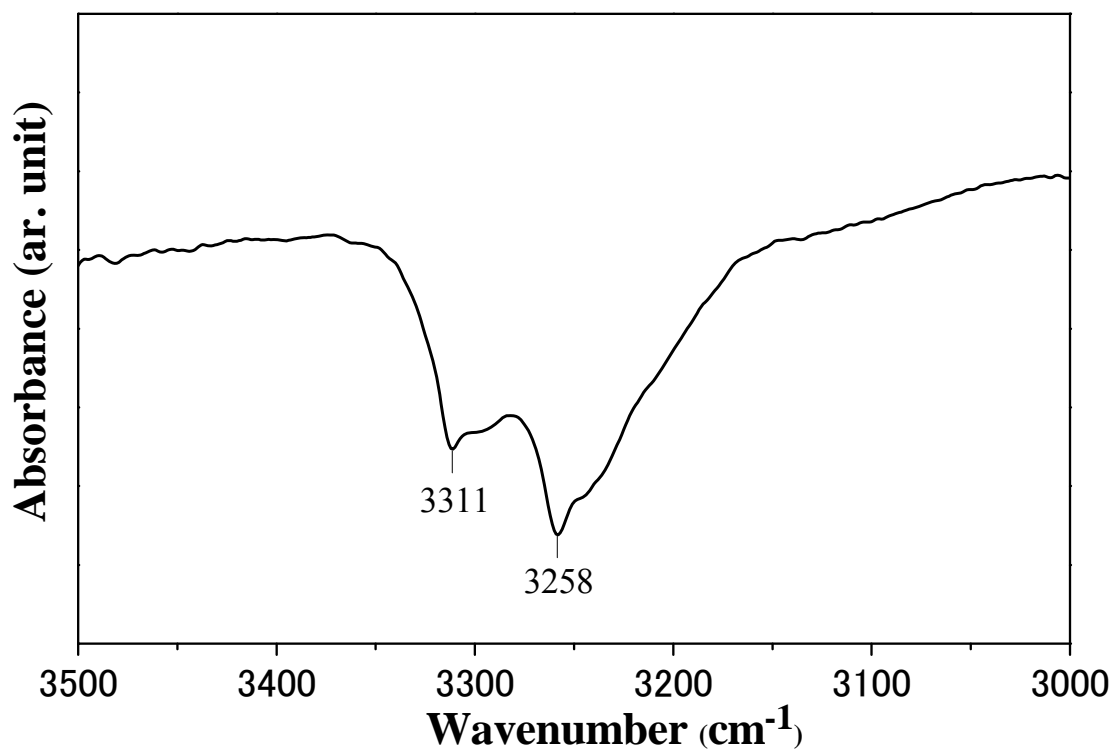


Fig. S2: FTIR of the ball-milled composite of LiH and KNH<sub>2</sub> with 1/1 molar ratio.

## Notes

Lithium hydride (LiH) (99.4%, Alfa Aesar), potassium hydride (KH) (99.5%, Aldrich), and potassium amide (KNH<sub>2</sub>) synthesized from the KH and NH<sub>3</sub> (Japan Fine Products, 99.999%) were used for the experiments. LiH, KH, and the 5 mol% KH-added LiH were mechanically milled for 2 hours under 1.0 MPa H<sub>2</sub> atmosphere using a planetary ball mill apparatus (P7; Fritsch) for activation, where we empirically confirm that our ball-milling treatment makes a homogeneous mixture in this condition.<sup>1,2</sup> The mixture of KNH<sub>2</sub> and LiH with 1/1 molar ratio was prepared by the ball-milling for 2 hours at 1.0 MPa H<sub>2</sub> atmosphere or hand-milling for 30 minutes as reference. All the samples were handled in a glove box (Miwa MFG, MP-P60 W) filled with purified Ar (>99.9999%) to avoid an oxidation and hydration due to water. The amount of H<sub>2</sub> generated by the reaction between MH (LiH, KH, and the KH-added LiH) and NH<sub>3</sub> was determined as follows. A weighed amount of MH was packed into a pressure vessel. NH<sub>3</sub> pressure of 0.5 MPa with a ratio of NH<sub>3</sub>/MH = 1 mol/mol was introduced into the vessel at room temperature or 100 °C. The weight gain in the solid products was measured to determine the yield of the reaction. The reaction products were identified by X-ray diffraction (XRD) measurements (Rigaku RINT2000, Cu K $\alpha$ ). IR spectra were collected by Fourier transform IR spectrometer (FTIR, Perkin-Elmer) with accumulation 128 scans.

1. (a) T. Ichikawa, S. Isobe, N. Hanada and H. Fujii, *J. Alloys Compd.*, 2004, **365**, 271;  
(b) T. Ichikawa, N. Hanada, S. Isobe, H. Leng and H. Fujii, *J. Phys. Chem. B*, 2004, **108**, 7887;
2. (a) S. Isobe T. Ichikawa, N. Hanada, , H. Leng, M. Fichtner, O. Fuhr, and H. Fujii, *J. Alloys Compd.*, 2005, **404**, 439, (b) N. Hanada, T. Ichikawa, and H. Fujii, *J. Alloys Compd.*, 2005, **404**, 716