DSC technique was applied to collect the temperatures ($T_p$) at the maximum reaction rate at various heating rates ($\beta = 1, 2, 3$ and $4$ K min$^{-1}$). Kissinger’s method was adopted in determining the activation energy ($E_a$) and the pre-exponential factor ($A$):

$$E_a = -R \frac{d \ln(\beta/T_p^2)}{d(1/T_p)}$$

$$A = \beta E_a \exp\left(E_a/RT_p^2\right)/RT_p^2$$

The reaction rate constant can be obtained by Arrhenius equation:

$$K = A \exp\left(E_a/RT_p\right)$$

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Fig. S1 (a) DSC curves of the TPP-doped and pristine 1Mg(NH$_2$)$_2$-2LiH sample measured at different heat rates: 1, 2, 3 and 4 K min$^{-1}$. (b) The reaction rate constants dependent of
temperatures for the TPP-doped sample and pristine sample. The rate constants of TPP-doped sample are almost three times the values of pristine sample in the testing temperature range.

Fig. S2 Pressure-composition-temperature (PCT) isotherms of the TPP-doped 1Mg(NH$_2$)$_2$-2LiH at 170 °C.

Fig. S3 DSC curves of amorphous and crystalline Mg(NH$_2$)$_2$. Amorphous Mg(NH$_2$)$_2$ was prepared by ball milling the crystalline Mg(NH$_2$)$_2$ for 36h. The exothermic peak around 275 °C should be ascribed to the amorphous-crystalline transition of Mg(NH$_2$)$_2$. But it’s hard to get a precise value of heat of crystallization because this change somehow overlaps the decomposition of Mg(NH$_2$)$_2$. 