CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this research, the desorption behaviors and desorption temperature of $LiAlH_4$ were investigated by mixing CAs and catalysts including Ti, TiO_2, $TiCl_3$, and Ni. $LiAlH_4$ mixed with a low amount of CAs, 5 wt%, not only exhibited the best desorption behaviors, but also showed the good hydrogen desorption capacity, 7.3 wt% hydrogen, and the second desorption temperature was decreased by 20 °C acompared with the as-received sample. Although $LiAlH_4$ mixed with 15 wt% CAs reduced the desorption temperature in the first desorption steps to 115 °C, it did not decrease the second desorption step. Surprisingly, a new unknown compound was generated at this ratio, which was not Li_2C_2. In addition, mixing 5 wt% TiO_2 and $TiCl_3$ exhibited the best catalytic effects on the first and second desorption steps, in which the desorption temperature was decreased by 50 and 60 °C, respectively. However, their desorption behaviors was not as good as adding 5 wt% CAs. It can be explained that Al_3Ti, which acts as an active species, may be formed during the mechanical milling. However, adding either TiO_2 or $TiCl_3$ exhibited similar results in the hydrogen desorption capacity of $LiAlH_4$ mixed with 5 wt% CAs. Furthermore, $LiAlH_4$ co-mixed with 5 wt% CAs and 5 wt% catalysts, TiO_2 or $TiCl_3$, also reduced the first and second desorption temperatures to 95 and 175 °C, which was lower than adding only TiO_2 or $TiCl_3$. Their desorption behaviors was also improved for the co-mixing. However, the absorption of dehydrogenated samples mixed with CAs, catalysts, and CAs and catalysts cannot re-absorb hydrogen under H_2 pressure 11 MPa at 180 °C.

5.2 Recommendations

The preparation is one factor that affects the reversibility of $LiAlH_4$. The ball milling technique used in this work may not facilitate the hydride through the

pores of CAs. Another method like compressed $LiAlH_4$ in THF under H_2 pressure after the ball milling is worth considering to improve the reversibility of $LiAlH_4$.