Regeneration Properties of Potassium Based Solid Sorbents for CO_2 Absorption

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The regeneration properties of sorbents prepared by impregnation of potassium carbonate were evaluated by observing the amount of CO_2 desorbed by heating at 150−400°C in a fixed bed reactor. To understand the regeneration property in detail, a TPD test was performed after CO_2 absorption at 60°C. Only one CO_2 peak in the TPD was found in the case of K_2CO_3/AC and K_2CO_3/MgO. The peak temperatures of K_2CO_3/AC and K_2CO_3/MgO were at about 130°C and 360°C, respectively. However, two CO_2 peaks were observed in the TPD result for K_2CO_3/Al$_2$O$_3$. One peak was found at 106°C and the other was observed at temperature above 290°C. XRD pattern of K_2CO_3/AC after CO_2 absorption showed only $KHCO_3$ crystal structure which could be easily regenerated at low temperature like 150°C. XRD pattern of K_2CO_3/MgO also showed one phase which was assigned to $K_2Mg(CO_3)_2$. While, XRD pattern of K_2CO_3/Al$_2$O$_3$ sorbent after CO_2 absorption showed two phases assigned $KHCO_3$ and $KAl(CO_3)_2(OH)_2$. The decrease in the CO_2 capture capacity of K_2CO_3/Al$_2$O$_3$ and K_2CO_3/MgO at lower temperature than 250°C could be explained through the formation of $KAl(CO_3)_2(OH)_2$ and $K_2Mg(CO_3)_2$, respectively, which was not completely converted in the original K_2CO_3 phase.