

Improvement of Amine-Based CO₂ Sorbent and Evaluation of its Behavior in Ad/desorption TSA process

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In the recent decade, scientist studied the greenhouse gases (GHGs) like carbon dioxide (CO₂), methane (CH₄), and other gases that affect global warming [1-2].

Carbon dioxide capture and sequestration (CCS) is a variety of technology, wherein various processes such as physical and chemical absorption, adsorption and membrane separation have been proposed [3].

Amines show high CO₂ selectivity so they are widely applied to CO₂ adsorption. However depending on the amine structure (primary, secondary, tertiary), they show disadvantages such as in stability, because of the formation of irreversible chemical species such as urea and amide caused by CO₂ and air degradation at high temperature, respectively. In general secondary amines are more stable than other orders of amines [4].

In this study, [3-(methylamino)propyl] trimethoxysilane (1NS-S), and N-[3-(Trimethoxysilyl)propyl]ethylenediamine (2NS) were functionalized on silica supports using the incipient wetness technique. 1,2-epoxypropane (EP), and 1,2-epoxybutane (EB) were used as 2NS modification agents. CO₂ sorption capacity and cyclic performance evaluation were studied by TGA. The primary amine modification with epoxide was confirmed by FT-IR, ¹H and ¹³C-NMR. The change in desorption temperature due to epoxide modification was confirmed by CO₂-TPD and FT-IR.

Figure 1 shows the CO₂-TPD profiles, from which can be deduced that the secondary amine sorbents were easy to desorb at low temperatures. As a result, the formation of

deactivation species at high temperature can be inhibited.

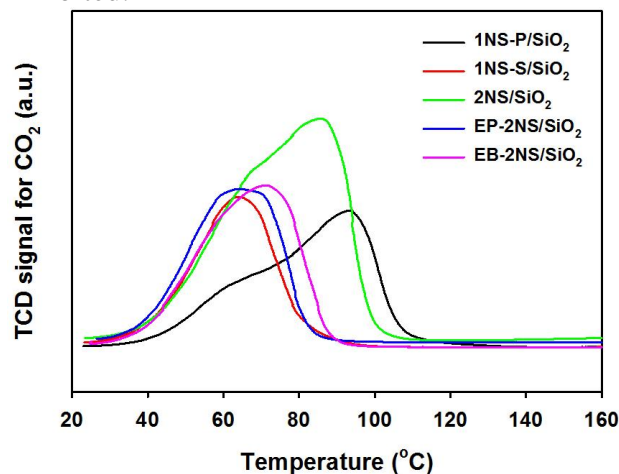


Fig.1. CO₂-TPD profiles of sorbents.

In the actual process, the gas composition and temperature are different depending on the position of the fluidized bed reactor. Figure 2 shows that desorption of the secondary amine sorbents were desirable.

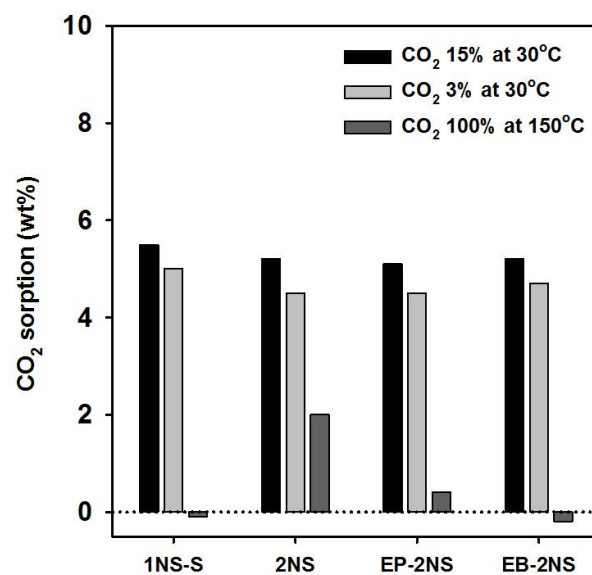


Fig.2. CO₂ sorption capacity depending on the reactor position.

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