Akarat Akgsornpeak 2013: Preparation of Highly Stable CaO Sorbent for CO_2 Capture. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Assistant Professor Thongthai Witoon, Ph.D. 65 pages.

The alternation between uptake and release of CO_2 by CaO sorbents is a promising way for removal of CO_2 from a hot gas stream. The main drawback of this method is the deterioration of CO_2 capture capacity following multiples cycles. This research presents the development of synthetic CaO sorbents via a sol-gel and precipitation methods using cetyltrimethylammonium bromide (CTAB) as an agglomeration inhibitor. Effect of Ca^{2+}: CTAB molar ratios on physical properties of the CaO sorbents as well as their CO_2 capture performance were investigated. Calcination behavior, crystal type and crystallinity, morphology and BET surface area of the obtained products were characterized by means of thermal gravimetric and differential temperature analysis (TG-DTA), X-ray diffraction (XRD), scanning electron microscope (SEM), and N_2-sorption. The CO_2 uptake – release cycles were carried out using TG unit with high purity CO_2. The addition of CTAB had a significant influence on the physical properties of the CaO sorbents. In case of sol-gel method, the presence of CTAB was found to effectively prevent an agglomeration of CaO particles, and to greatly increase BET surface area and total pore volume of the resulting CaO sorbents. The CaO sorbent prepared via sol-gel method at the Ca^{2+}: CTAB molar ratio of 10:3.0 had the highest surface area and total pore volume of 11.85 m^2/g and 0.31 cm^3/g respectively. It achieved the highest carbonation conversion of 82.42% in the first cycle, and retained an excellent carbonation conversion of 68.63% subsequent to 11 consecutive test cycles. In case of precipitation method, the CTAB could reduce the size of CaO particles. Self-reactivation phenomenon was found for all CaO sorbents prepared via precipitation method. The CaO sorbent prepared at the Ca^{2+}: CTAB molar ratio of 25:6.0 exhibited the highest carbonation conversion of 54.60% in the first cycle. Subsequent to 11 consecutive test cycles, the carbonation conversion was almost constant at 56.60%.

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