CO_2 capture by modified diatomite

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Abstract

The calcium oxide is a potential CO_2 sorbent due to its great CO_2 adsorption capacity. However, the surface area and porosity of CaO are eliminated by the sintering effect during the sorption/desorption process, then the adsorption capacity and the stability would be declined. To overcome these drawbacks, CaO is combined with the diatomite to cease the side-effect of sintering. Diatomite is a porous material with high specific surface area, surface electronegativity, and high porosity. Moreover, the surface area and porosity could be enhanced by chemical modification. In this study, diatomite is modified by H_2SO_4 solutions to corrode the surface structure, and promote its specific surface area and porosity. Then the modified-diatomite is analyzed by using scanning electron microscope, surface area and porosity analyzer and X-ray diffractometer to observe the morphology, porosity, and crystalline structure, respectively. And then CaO and modified-diatomite is combined with molar ratio of 100/0, 95/5, 75/25, 55/45 and 35/65. The CO_2 adsorption capacity and efficiency is examined by the thermo-gravimetric analyzer. The CO_2 adsorption mechanism via the property analysis before and after CO_2 adsorption is also discussed. The results show that the samples of CaO-100 and CaO-95 have a better CO_2 adsorption efficiency, and the sample of CaO-95 has the best CO_2 adsorption stability. However, the chemical reaction between diatomite and CaO results in the formation of calcium silicate and decline the amount of CaO in the composite. This leads to the composite having a lower stability of CO_2 adsorption/desorption processes.

Keywords: Calcium oxide, diatomite, modification, carbon dioxide, adsorption.