Characteristics of SO_2 removal by using $CaCO_3$ sorbent particle in an oxy-PC combustion system

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CCS (CO_2 capture and storage) is the technology which can directly reduce the emission of greenhouse gases. oxy-PC combustion system (which is one of the CCS capture technology) has advantages over other systems because it is economical and recovers the CO_2 with high purity. in oxy-PC combustion, flue-gas recirculation creates an atmosphere that is primarily CO_2 with a small amount of O_2. Therefore, the phenomena of sorbent particles in an oxy atmosphere are different compared with those in an air atmosphere.

SO_2 removal experiments by using $CaCO_3$ sorbent particle was performed in a drop tube furnace experimental setup in air atmosphere and oxy-PC atmosphere.

To estimate the effect of temperature in a reactor on a particle behavior and SO_2 removal characteristics, experiments were conducted by varying a temperature 800-1100°C. Reaction time in a reactor was set to 2 sec. As seen in Fig. 1, SO_2 removal efficiency increased with temperature rise in an air atmosphere, while it had maximum value between 900-1000°C in an oxy-PC atmosphere. in general, adsorption became enhanced as the temperature increased. However, in an oxy-PC atmosphere, the degree of adsorption showed the maximum value due to the significant sintering effect. Furthermore, decomposition phenomenon of the adsorbed SO_2 from the sorbent particle accelerated the decline of the SO_2 removal efficiency.

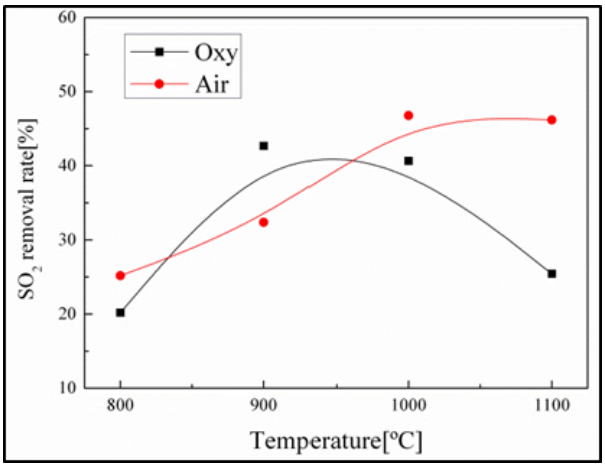

Figure 1. SO_2 removal rates by varying a temperature in air and oxy-PC atmospheres, respectively.

To estimate the effect of reaction time in a reactor on a particle behavior and SO_2 removal characteristics, experiments were conducted by varying a reaction time 1.0-2.0 sec. Temperature in a reactor was set to 1000°C. Figure 2 shows the SO_2 removal efficiencies by varying a reaction time in an air and oxy-PC atmospheres, respectively. As seen in Fig. 2, SO_2 removal efficiency showed the same level within the experimental conditions in an air atmosphere, while it increased until the reaction time of 2 sec. It was attributed to CO_2 partial pressure in an oxy-PC atmosphere. In an oxy-PC atmosphere, calcination was delayed due to the higher CO_2 partial pressure in a surrounding medium. Thus, it takes long time to make the sufficient SO_2 adsorption in an oxy-PC atmosphere.

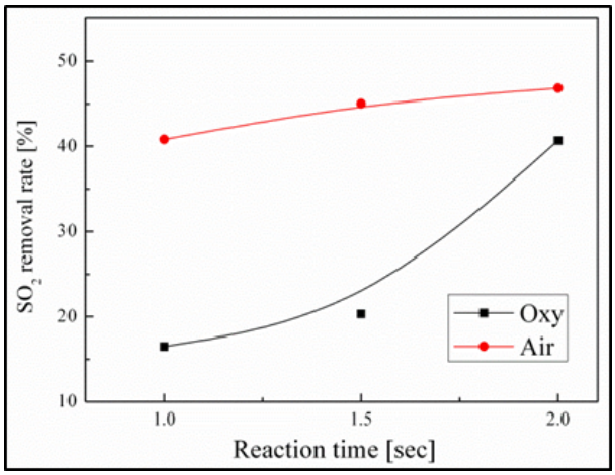

Figure 2. SO_2 removal rates by varying a reaction time in air and oxy-PC atmospheres, respectively.

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