Radiofrequency heated set-up for CO_2 capture with CaO sorbents

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Abstract

Power plants working on coal, gas and liquid fuel are one of the main contributors to the total CO_2 emissions. Due to their distribution, they are considered to be the most suitable localized centers for implementation of CO_2 capture technologies. By developing an integrated system of CO2 looping capable to operate at extreme temperatures of hot effluent power plant gas emissions, the problem of CO_2 mitigation can be resolved on a large scale, considering a consecutive conversion of the captured CO_2 into valuable products (methanol). CO_2 adsorption/conversion units can be integrated within power plants and powered during the periods of low energy consumption thus stabilizing the grid, reducing harmful emissions and yielding viable products. In this work, radio-frequency heated fixed bed reactor with CaO sorbent produced by template synthesis was proposed as CO_2 looping system. CaO-sorbents, prepared by template synthesis, benefit from higher pore volume and better stability under high temperature over several cycles. In comparison to conventionally heated reactor, which presents poor control and long stabilization, RF heating provided fast heat-up and cool-down regimes, overall better control of the temperature and less heat losses (Fernandez et al., 2016). Under RF heating, CaO sorbent achieved its stable operation in much shorter period of time (10-15 cycles in comparison to 35-40 for conventional heating). In addition, higher desorption rate of CO_2 and lower degree of the sorbents sintering was observed for RF facilitated heating in comparison to conventional set up. It has been suggested that the implementation of this set-up in power energy plants is feasible.

Biography:

Fernández, J; Sotenko, M.; Derevschikov, V.; Lysikov, A.; Rebrov, E.V. A radiofrequency heated reactor system for post-combustion carbon capture. Chemical Engineering and Processing, 108 (2016) 17.