CMTC 151373

CO_2 Capture Using Advanced Carbon Sorbents

G. Krishnan, M. Hornbostel, J. Bao, A. Sanjurjo, SRI International; J. Sweeney, D. Carruthers, M. Petruska, ATMI

Abstract

The immediate application of this technology is to capture 90% CO_2 from the flue gas of a pulverized coal (PC) fired power plant at no more than a 35% increase in cost of electricity The technology is being tested a large bench scale level and it will be tested, in the future, using a slip stream from an operating PC-fired boiler.

In the bench-scale tests, we achieved a capture efficiency of 98% with the product CO_2 gas purity of >97%. The advanced carbon sorbent process is based on two unique components: carbon sorbent granules made by ATMI and a novel reactor configuration developed by SRI. The carbon sorbent has a high CO_2 capacity, rapid adsorption and desorption rates, low heat requirement for sorbent regeneration, extremely low attrition rate, and high hydrothermal stability. An integrated adsorber-stripper reactor system developed at SRI allows the sorbent granules move, by gravity, from the adsorber to the stripper. The integrated system, based on falling granules geometry, enables the integration of adsorption and stripping of the CO2 in a single vertical column. Adsorption is performed at about 30 degrees Celsius while desorption is accomplished using low pressure steam at about 100 degrees Celsius. The regenerated granules, after cooling, are cycled back to the absorber. The integrated reactor allows a low pressure drop for the passage of the flue gas streams and direct contact with steam for efficient heat transfer during stripping. The integrated system has been tested for 1000 cycles with excellent reproducibility and stability.

Development of this system will provide a cost-effective technology for removing CO_2 from the flue gas of existing and new PC-fired plants, suitable for subsequent sequestration or other uses. Successful development of this technology will reduce greatly the emission of CO_2, a greenhouse gas into the atmosphere.