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THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

Pilot-Scale Demonstration of the OSCAR Process for High-Temperature Multipollutant Control of Coal Combustion Flue Gas, Using Carbonated Fly Ash and Mesoporous Calcium Carbonate

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Abstract (Summary)

A pilot-scale study of the Ohio State Carbonation Ash Reactivation (OSCAR) process was performed to demonstrate the reactivity of two novel calcium-based sorbents toward sulfur and trace heavy metal (arsenic, selenium, and mercury) capture in the furnace sorbent injection (FSI) mode on a 0.365 m³/s slipstream of a bituminous coal-fired stoker boiler. The sorbents were synthesized by bubbling CO₂ to precipitate calcium carbonate (a) from the unreacted calcium present in the lime spray dryer ash and (b) from calcium hydroxide slurry that contained a negatively charged dispersant. The heterogeneous reaction between these sorbents and SO₂ gas occurred under entrained flow conditions by injecting fine sorbent powders into the flue gas slipstream. The reacted sorbents were captured either in a hot cyclone (~650 °C) or in the relatively cooler downstream baghouse (~230 °C). The baghouse samples indicated ~90% toward sulfation and captured arsenic, selenium and mercury to 800 ppmw, 175 ppmw and 3.6 ppmw, respectively.