PPDO-103

Recovery and Regeneration of Activated Carbon for Mercury Capture In Pulverized Coal Boilers

Edward K. Levy
Professor, Energy Research Center, Lehigh University

Christopher Kiely
Professor, Department of Materials Science & Engineering, Lehigh University

Zheng Yao
Graduate Student, Energy Research Center, Lehigh University

Industry Participants
PPL Generation LLC and DTE Energy

Abstract

All coal-fired boilers emit small concentrations of gas-phase mercury (Hg) to the atmosphere as part of the stack gas, Hg being one of several toxics which originate in the coal. As a result of scientific evidence that mercury is harmful to people, EPA will soon be issuing regulations requiring that Hg emissions from coal be controlled. One of the techniques for Hg capture in coal-fired boilers involves injection of activated carbon (AC) into the boiler downstream of the air preheater. Hg is adsorbed onto the AC particles and fly ash, which are then both removed in an electrostatic precipitator or baghouse. While field trials with AC injection have demonstrated the ability to remove significant fractions of the Hg at some units, there are also problems in using AC for Hg capture. Activated carbon is relatively expensive, leading to very high projected costs for Hg capture. The feed rates of AC required for Hg control will also result in significant increases in carbon content of the ash. However, fly ash used in concrete must have carbon contents of 4% or less in order that the concrete have acceptable mechanical properties. This has raised concerns that widespread use of AC for Hg capture will eliminate concrete as a viable market for reuse of ash, thereby greatly reducing the percentage of coal ash which can be reused.

This project addresses the issues of Hg on activated carbon and on fly ash from a materials re-use point of view. It also addresses the possible connection between Selective Catalytic Reduction (SCR) reactors, fly ash properties and Hg capture. The project will determine the feasibility of separating AC from fly ash in a fluidized bed and of regenerating the separated AC by heating the AC to elevated temperatures in a fluidized bed. The project will also determine the temperatures needed to drive off the Hg from the ash in a fluidized bed. Finally, samples of fly ash from power plants with SCR reactors for NO_x control, will be analyzed to determine the effect of SCR on the ash. These analyses will also determine the properties of ash which are important for Hg capture.