

XAFS Investigation of Hg Sorption by Fly-Ash and Other Materials

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Abstract:

Various materials have been proposed as low-cost sorbent materials for the capture of vapor-phase mercury forms at low temperature from combustion flue gases. Among the most cost effective materials for this purpose appear to be various carbon-based materials, including unburnt-carbon-containing fly-ash from combustion of certain coals. We have recently begun to use XAFS spectroscopy to investigate the bonding and structure of mercury species formed as a result of the sorption process. Examination of mercury sorbed on activated carbons and other carbonaceous materials has established that the bonding of the mercury is determined either by the activating element (e.g. S or I) on chemically activated carbons and/or by acidic species, especially HCl, in the gas phase that are adsorbed by the carbon prior to or contemporaneously with the sorption of the mercury. Such considerations are likely also to apply to fly-ash, with the possible extra complication that inorganic species present in the dominant aluminosilicate/ glass fraction may also be capable of sorbing mercury in addition to the carbonaceous components. Analysis of carbon-rich and carbon-poor fractions separated from fly-ash samples by means of dry triboelectrostatic separation has shown that the mercury correlates strongly with the carbon content, and that not all carbon forms are equally effective in sorbing carbon.