Inorganic Components in Coal and Their Behavior at Elevated Temperatures

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The unexpected behavior of inorganic components in coal at elevated temperatures has humbled many researchers and technology developers. Many coal utilization technologies are developed with out an adequate assessment of the impacts of the inorganic components present in coal. The abundance and forms of inorganic components vary between coal types, coal seams and within the seams. Subbituminous and lignitic type coals contain organically associated and minerals. Bituminous and anthracite coals contain mainly minerals. During heating the inorganic components are transformed to gases, liquids, and solids. The characteristics of the inorganic gases, liquids, and solids reflect the association and abundance of the inorganic components in the coal and system conditions such as temperature and gas composition. Analysis of fly ash produced during combustion is highly complex and variable both in size and composition. Fly ash typically has a bimodal size distribution. The submicron size particles form as a result of condensation of flame-volatilized species upon gas cooling. The larger sized particles are derived from the non-volatile inorganic components. The physical and chemical properties of the ash intermediate species can cause significant challenges to the efficient and reliable operation of coal utilization technologies. The challenges include wear of system components, maintaining slag flow in wet bottom system, formation of deposits on heat transfer surfaces, formation of agglomerates in fluidized bed system, blinding and plugging of selective catalytic reduction systems for NOx, and controlling the emission of toxic inorganic components. Many of the adverse impacts of inorganic components are being minimized through the use of more sophisticated methods of coal analysis and prediction. In addition, control technologies are being demonstrated to control the emission of volatile inorganic components such as mercury.

A full manuscript will be published in Fuel.