# Formation Characteristics of Fine Particulates with Na Compounds during Coal Combustion

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## abstract

Some metal compounds in coal vaporize and form fumes during the combustion. The fumes are usually exhausted through the flue gas. For coal-fired combined power generation systems such as pressurized fluidized bed combustion (PFBC), hot metallic vapors may contact with the surfaces of gas-turbine blades. Since this contact of the hot vapors with the surface has a corrosive effect, it is necessary to control the formation of those fumes, which contain alkali metal compounds. In this paper, the evolution behavior of alkali metal compounds, especially sodium compounds, has been studied, using an electrically heated drop tube furnace with a low-pressure impactor. The main objective in this study is to elucidate the conditions and the possible mechanisms to form alkali metal compounds in particulate matter during combustion. Two types of coal with different sodium contents were tested, where the coal conversion characteristics were established. Furthermore, the evolution and inclusion of sodium compounds into the sub-micron particles were studied in relation to the particle size distribution and sodium fraction distribution in the collected particulates. The study proved that the evolution and inclusion of sodium on sub-micron particles depended on the functions of the coal type. The reaction-controlled mechanism and heterogeneous condensation via chemical reactions during the combustion much more influenced the inclusion of sodium in sub-micron particles. At the coarse particles of above about 0.5 μm, the reaction that formed the particles was mainly via gas film diffusion surrounding the particle.

## Keywords

Coal, Combustion, Alkali Metal, Fine Particulate, Fluidized Bed Combustion