Devolatilization modeling of large coal particles using DAEM

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Many models have been built for the coal particles devolatilization, but they are almost focused on the small coal particles, which could ignore the temperature gradient within the particles, previous study showed a chemical kinetics controlled regime for small particles, and the Biot number should be assumed smaller than 0.02. This paper provides a model for devolatilization of large coal particles (≥ 1mm), which is controlled by the heat transfer produced by the convection and radiation in the gas-solid fluidized bed, the Biot number is larger than the small particles. The temperature distribution within the coal particle can not be ignored and could be obtained from the one-dimensional spherical coordinate unsteady heat transfer equation with the convective boundary condition and then the temperature can be used in the non-isothermal coal decomposition kinetic expression proposed by the Anthony et al. to get the devolalitization expressed by the fractional volume average devolatilization at any given time. The model predictions were compared with experimental data for CH_4 evolution, reported by Morris and Keairns for different particle sizes and at different temperatures with good agreement.