

Effect of thermal radiation on modeling of moist organic dust combustion

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Abstract

In this paper our last model is extended and thermal radiation is taken to account, which is a dominant mechanism in organic dust combustion. Also effects of devolatilization temperature and particle radius are investigated in this paper. One dimensional model is used to evaluate the flame characteristics. The flame structure is divided into three zones: preheat zone, reaction zone and post-flame zone. Also preheat zone is also divided into four subzones itself: first heating subzone and drying subzone, second heating subzone and volatile evaporation subzone. The obtained results show that the induced thermal radiation from flame interface into the preheat and vaporization zones plays a significant role in the improvement of vaporization process and burning velocity of organic dust mixture, compared with the case in which the thermal radiation factor is neglected. According to results, burning velocity and mass fraction of gaseous fuel strongly depend on radiative heat transfer. By considering radiation effect our results have better agreement with experimental data.

Keywords: Organic particles, Thermal radiation, Devolatilization temperature, Particle radius, Burning velocity, Gaseous fuel mass fraction.

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