



Vortrag



Numerical Modelling of SRF plastic Combustion

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The world is facing energy crisis and increasing energy prices within the next few decades. The co-firing process with the SRF (solid recovery fuel) as the secondary fuel provides a reasonable and attractive option of energy production. Plastic material is one of the most important fraction in SRF fuels. In order to present its unique combustion characteristics, several experimental and numerical researches were performed as following:

Firstly, characterization of non-spherical particles based on settling velocity and optical view were carried out for the simulation. Several separation and classification technology were introduced, which provided data like the mass fraction taken by the plastic in SRF, mass and diameter distribution of the plastic sample, as well as the important physical-chemical properties.

Secondly, reasonable mathematical model were built based on the theoretical researches of the existing publication. Due to the highly irregular shape, the plastic particles usually have large aspect ratios. The specific force balance for the non-spherical plastic must be built. On the other hand, because of the special combustion and decomposition mechanisms of polymers, the default heat transfer and shrinkage treatment in FLUENT were not quite suitable for the plastics particles. Thus a pure implicit scheme utilizing tri-diagonal matrix algorithm (TDMA) was used for solving 1-D heat transfer model inside the particle. All those mechanisms were carried out through the DPM multiphase modeling in FLUENT. Several Macros like User defined body force, heat transfer law and source term were applied for the tracking of the particles, which provided a better agreement with the experimental data compared with the default laws.

Thirdly, after we tested and optimized the special movement, heat and mass transfer numerical model for the single particle, several cases for the plastic injection and the cofiring injection in a burner were set and followed with several qualitative analysis. From which the advantage and disadvantages in the thermal application of SRF plastics were showed. Different settings for the analysis of sensibility in turbulence model, chemistry model, combustion model and the initialization were compared and discussed through the demonstration of the important characteristic factors like flame temperature field, species distribution.

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