ALTERNATIVE FUELS

(695) - (*) - MODELLING SOLID RECOVERED FUEL (SRF) COMBUSTION FOR THERMAL POWER GENERATION

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Non-recyclable solid waste currently ends up at landfill sites, which is an environmental hazard as well as a disposal issue for local councils. If not sent to landfill sites, a small portion will be incinerated or co-fired with other solid fuels in, for example, cement kilns. In order to use these end-of-waste products for thermal power generation, some of the hazardous material can be removed from the raw feed, with the remaining waste product defined as solid recovered fuels (SRF). Although pure 100% SRF firing for energy production has not yet been attempted in conventional power plants, the potential for such application exists which was investigated as a FEED study at a major power plant in the UK. The main issues with SRF include the significant heterogeneity of the fuel mixture, comprising of plastics, paper/cardboard, biogenic content as well as textiles, rubber and miscellaneous impurities. This, combined with a fraction of large plastic particles and "fluffy" fibrous material entering the burner makes it a challenge to burn all materials while maintaining emissions within legal limits. It is imperative to develop an efficient and reliable low-emission system which also minimises particle drop-out. This is a complex challenge which warrants a highly detailed CFD modelling approach.

A computational fluid dynamics (CFD) model was developed to accurately capture multi-component particle heat-up, melting and aerodynamics, and then linked with commercial CFD code ANSYS FLUENT using its user defined function (UDF) interface. The model is versatile in its application of range of different particle shapes (spherical, cylindrical, and flake), types (plastics, paper, cardboard, biomass, coal) and sizes to adequately represent the SRF mixture. In addition, number of algorithms were developed to explicitly predict the composition, volatile speciation and particle size distribution of each SRF constituent in order feed into the CFD combustion model.

A combustion test campaign was then conducted in order to provide baseline data for the model, firing 100% SRF in a small-scale furnace (500kW) under several different conditions. The CFD model was applied to attempt to match the test data. The results are encouraging, with a good agreement of flame shape and temperature as well as NOx emissions. This work will lay the foundation for the design of a novel full-scale 100% SRF burner concept.

Palavras-chave : SRF, Multi-Fuel Combustion, CFD