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Segregation of char and wood in a cold bubbling fluidised bed of sand for biomass gasification applications.

B.Cluet^a, G.Mauviel^b, Y.Rogaume^a, O.Authier^c and A.Delebarre^{d*}

^aLERMAB;

27 rue Philippe Séguin;BP 1041; 88051 Epinal Cedex 9 France

^bLRGP;

1 Rue Grandville ; BP 20451 ; 54001 Nancy France

^cEDF R&D, Département Mécanique des Fluides, Energies et Environnement

6, Quai Watier ; BP 49 ;78400 Chatou France

^dLEMMA, ESSTIN

2, rue Jean Lamour ; F-54519 Vandoeuvre Lès Nancy Cedex France

*T :+33-383-685-100, F:+33-383-685-010 E : Arnaud.Delebarre@esstin.uhp-nancy.fr

Among the biomass gasification technologies, bubbling fluidised bed is well adapted for combined heat and power production in the 1-10 MWe range. However this technology is not yet mature.

One key point for its development is a better understanding of the biomass particles hydrodynamics inside the bed. The quality of the syngas and the efficiency of the reactor directly depend on the location of the particles at each phase of their conversion (drying, pyrolysis, char gasification). Bruni et al. [1] showed that endogenous bubbles generated by devolatilisation carry the biomass particles to the bed surface. Since Bruni et al.[1] restricted their study to incipient fluidization, this observation should be assessed for turbulent fluidization which is typical for biomass gasifiers.

The hydrodynamics of bubbling fluidized bed has already been investigated experimentally in hot device through high frequency differential pressure measurements [2].This method is used in this study to analyse segregation of biomass and char particles.

This present study achieves segregation experiments with different material in cold bubbling fluidized bed (20-50°C). Three types of materials are used to mimic characteristics of biomass during devolatilisation: wood particles with a solid density of 750 kg/m³, wood char particles with a solid density of 400 kg/m³and a new empirical material that could mimic biomass characteristics: density, shape, size, but also volatile matter release (same volatile content and volatile production rate). Fluidization experiments are achieved in cold device (25 cm ID). The bed consisted of olivine particles with an average particle size of 350 µm and a solid density of 3000 kg/m³(Geldart B classification). The mass ratio of biomass in bed is between 0 and 10%. Particles are injected over the bed or in the bed just above the air distributor. The comparison allows understanding and assessing the role of the characteristics of biomass property (density, shape) on particles hydrodynamics. The aim of this study is to produce correlations for segregation of biomass in bubbling fluidized bed.

The final goal of this work is to take into account the coupling between particles hydrodynamics and particles conversion in a global model representing a hot gasifier bubbling fluidized bed.

REFERENCES

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