Abstract

Title: **Surface Area, Volume, Mass, and Density Distributions for Sized Biomass Particles**
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OBJECTIVE

This project sought to characterize the shape and mass for biomass particles. Individual biomass particles have been characterized for their external surface area, volume, and drag coefficient/mass ratios. Analysis methods have been employed using shape and drag information to calculate mass and density distributions for these particles. Results of these measurements and analyses have been validated by independent mass measurements using a particle weighing and counting technique. Cofiring of biomass and coal has been identified as a promising way of reducing net CO_2 emissions with minimum modifications in the existing technologies. The successful accomplishment of the above objectives provides detailed particle property data required for developing improved combustion kinetic models for technologies involving cofiring of coal and biomass feedstocks.

ACCOMPLISHMENTS TO DATE

In this abstract, the work performed under DOE Grant No. DE-FC26-04NT42130 during the period July, 2006 to June 2007 which covers the third performance year of the project is described and the major accomplishments are highlighted summarizing the most important research results. Setting up, calibration, testing of the measurement systems with actual biomass particles have been completed to date. Also data collection using these measurement systems have been completed, and final results are reported here. This amounts to more than 85% of the proposed project work completed to date. During this reporting period, Morehouse completed analyzing the physical property data for biomass particles obtained by our sub contractor, REM Engineering services, employing the electrodynamic balance (EDB) measurement system discussed in the previous reporting periods. Results of the analysis for the physical property such as surface area (d_{sa}), volume (d_v), mass (m), and density (ρ) of biomass particles tested are reported here. The mean mass of 25 individual biomass particles obtained employing the EDB system is found to be 1.83×10^{-7} g. To date 32,133 particles were weighed and counted and the mean mass per particle from this gravimetric approach was found to be 1.823×10^{-7} g. It should be noted that this mean mass is to within ±1% of that obtained by the EDB approach discussed above.

FUTURE WORK

Remaining 15% of the project work including development of correlations for coal/biomass blends, and final reporting with recommendations to additional research is anticipated to be completed by July 31, 2007. Shape, density, and mass correlations for coal/biomass blends are being developed with previously published information obtained from similar research for coal particles. These correlations will be useful in predicting the burning rate of coal/biomass blends in co-firing combustors.

LIST OF PAPER PUBLISHED

R. Sampath, R. M. Dixon, M. D. Young, and G. Weirko-Brobby, Surface Area, Volume, Mass, and Density Distributions for Sized Biomass Particles, University Coal Research / Historically Black Colleges and Universities and other Minority Institutions Conference, sponsored by NETL/U.S. DOE, June 7-8, 2005, Pittsburgh, PA.

R. Sampath, C. S. Brown, M. Byars, and G. Saha, Surface Area, Volume, Mass, and Density Distributions for Sized Biomass Particles, University Coal Research / Historically Black Colleges and Universities and other Minority Institutions Conference, sponsored by NETL/U.S. DOE, June 6-7, 2006, Pittsburgh, PA.

R. Sampath, C. S. Brown, and M. Byars, Surface Area, Volume, Mass, and Density Distributions for Sized Biomass Particles, University Coal Research / Historically Black Colleges and Universities and other Minority Institutions Conference, sponsored by NETL/U.S. DOE, June 5-6, 2007, Pittsburgh, PA.

STUDENTS SUPPORTED UNDER THIS RESEARCH

To date, a total of three undergraduate students (Michael D. Young, George Weirko-Brobby, and Malikah Byars), and one graduate student (Gautam Saha) were supported under this research.

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