Design and Construction of an Entrained Flow Reactor

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Introduction

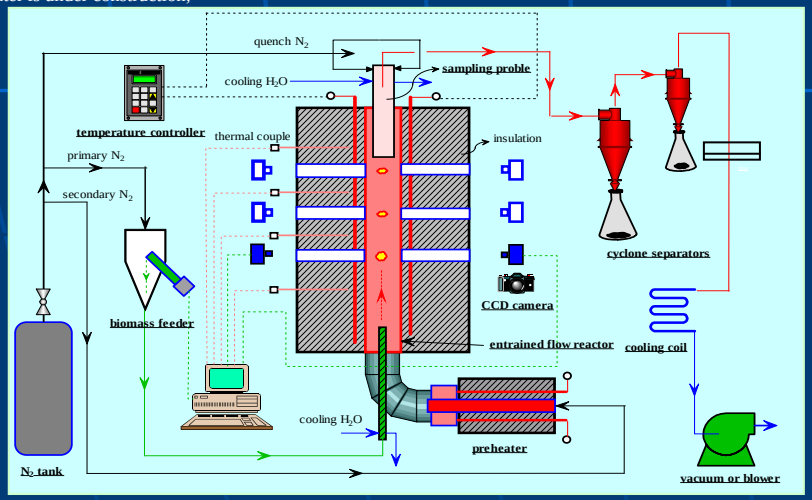
To better understand the effects of particle shape and size on biomass combustion, a high-tech entrained flow reactor is needed to collect experimental combustion data for biomass particles with different shapes and sizes.

Objectives

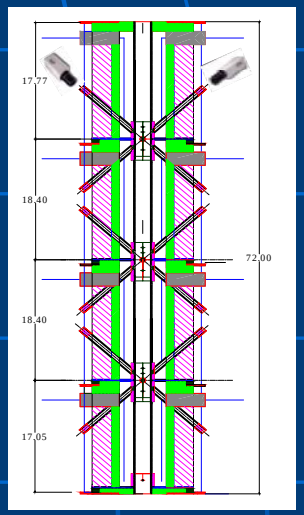
- Build an entrained flow reactor with the following capabilities:
  - Provide up to three seconds residence time for particles of size up to 1.5 mm;
  - Allow the temperature profile along the reactor to be separately controlled, with a maximum wall temperature of 1650 K;
  - A high efficiency preheater can heat the secondary gas temperature up to 1450K;
  - Provide optical access at three levels for particle image acquisition; at each level, optical access in three orthogonal directions is available;
  - An imaging system is mounted to take particle images and further extract particle surface temperature, volume, surface area, and size information as functions of residence time.

Progress

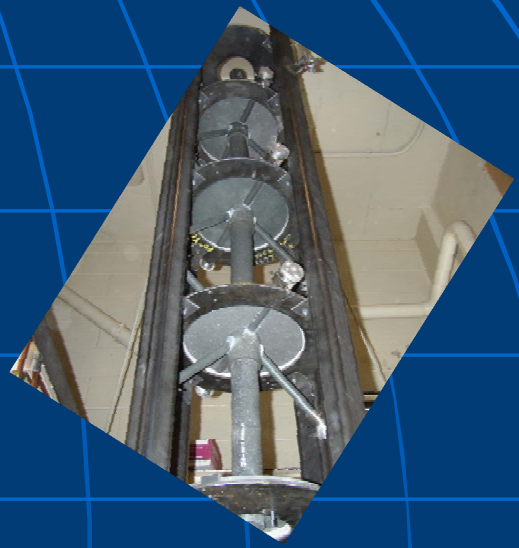
- The design for the whole system has been finished;
- The construction of the reactor body, temperature control system, feeding system, and collection system have been finished;
- Preheater is under construction;



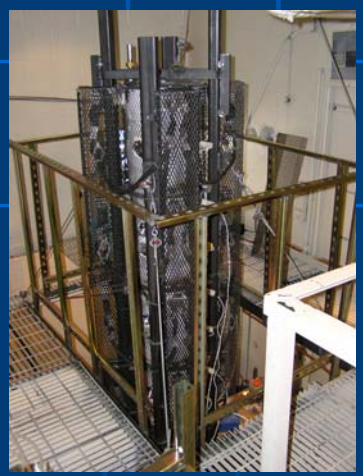
Process flow diagram



Drawing of the reactor body



Internal structure of the reactor



Finished reactor body

finished feeding and collection probes

Future Work

- Finish the construction of the preheater and mount the imaging system;
- Test the whole system and collect experimental data for particles of different shape and size.

Acknowledgement

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