



ANSYS[®] + IRSI

“Applying ANSYS software to our pyrolysis process gave us insight into our process and showed us how to make fundamental improvements to the efficiency of our thermal treatment parameters.”

Chris Olson

Owner

IRSI

Overview

Fabricating, testing and reiterating large, bioindustrial equipment is expensive and time-consuming. With ANSYS simulation, our team has been able to expedite the engineering refinement process and glean key insights into the operation of our equipment. Furthermore, the simulation model that we have developed can inform future configurations of our equipment and will accelerate future improvements.

Challenges

We were trying to understand the ideal operational parameters for the production of high-quality organic charcoal (biochar) from residual biomass. Using ANSYS software to model and simulate this process, we created a reiterative, insight-yielding process that has informed the real-world operation of our equipment.

Technology Used

- ANSYS Workbench
- ANSYS Fluent

Engineering Solution

To address our engineering problem, we used Fluent to simulate the thermal decomposition of the residual biomass under specific operating conditions. We were able to glean valuable information, including:

- The density of product and the evolution of density $[d\rho/dt]$ during thermal conversion
- Thermal characteristics of products such as thermal conductivity, specific heat capacity, porosity, total mass of products, residence time and total energy need
- The profile of temperature and distribution of heat flux along the system
- The composition of syngas versus time during the thermal conversion process

Fluent’s capabilities allow our engineers to understand the nature of biomass thermal conversion so we can design high-performance biofuel systems.

Benefits

The key benefits generated from the utilization of ANSYS software include:

- Costs savings for the fabrication of the future IRSI systems
- Improved performance efficiency of future systems
- Improved insight into the impact of specific parameters of the process
- Improved logistical management of the processing site

Company Description

IRSI designs, operates and oversees the fabrication of pyrolysis equipment for the production of value-added bioproducts. These include synthetic gas and organic charcoal (biochar). The business model for IRSI revolves around the upgrading of raw biochar into numerous value-added applications. IRSI has been operating in the bioindustrial space for six years and its upper management has 25 years (combined) experience with the company.

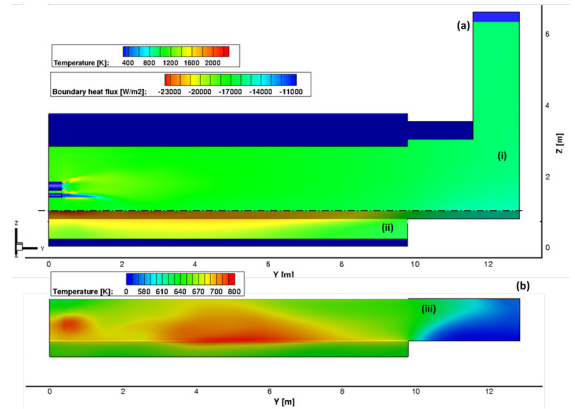


Figure 1. The contour of heat flux and temperature distribution in the IRSI indirect pyrolysis system. The volatile gas derived from the biomass material burns in the combustor to produce significant percentage of the heat required for thermal conversion (Energy, Vol. 169, pp. 1101-1111, 2019).

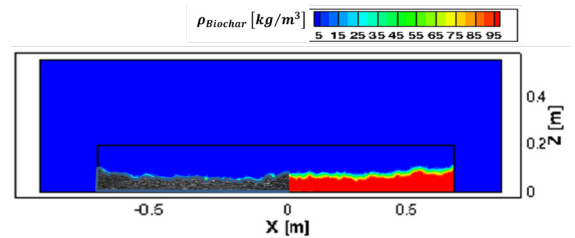


Figure 2. The schematic of the real biochar produced by IRSI (left side) and the simulation contour (right side). The red represents biochar density. The simulation was performed with ANSYS Fluent, in a study conducted by the University of Alberta and the University of Vigo.