This research was funded by: U.S National Scientific Foundation (Grant #: HRD-1242152)

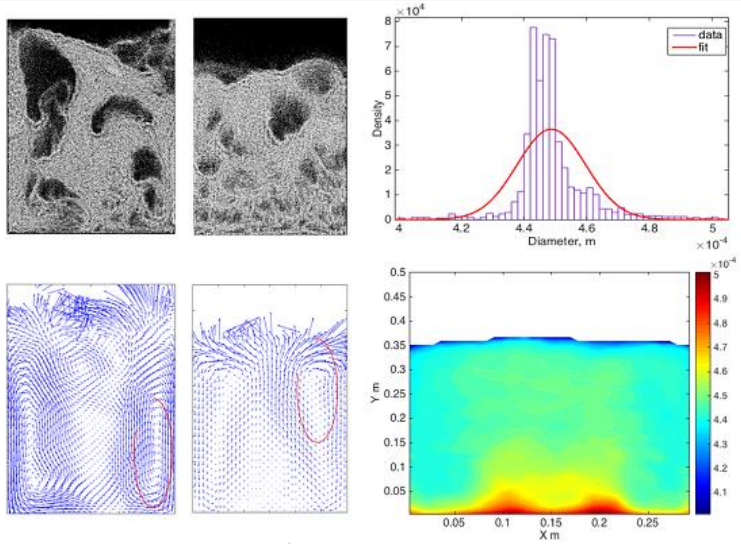
NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

Abolhasan Hashemisohi

Computational Science & Engineering

Dissertation Title: Numerical Analysis of Biomass Gasification in a Fluidized Bed Reactor

Major Professor: Dr. Lijun Wang



RESEARCH QUESTIONS / PROBLEMS:

- The syngas produced in the fluidized bed biomass gasification contains a significant amount of tar which can be reduced by optimization of the operating conditions.
- Operating conditions and parameters are related to each other in a complex way, it is essential to develop a mathematical model that can predict the effects of different parameters on syngas composition for scaling up and optimizing the gasifier.

METHODS:

- Develop an improved hybrid Eulerian-Lagrangian CFD model for prediction of bubble dynamics and mixing.
- Build a reactive network model that couples CFD and detailed kinetics models to improve the prediction of the tar components in the fluidized bed biomass gasification.

RESULTS / FINDINGS:

- Total tar content and heavy tars decreased by increasing the steam to biomass ratio from 0.3 to 0.9, and then increased again by further increasing the SBR at a constant reactor size, pressure and temperature.
- The simulations showed that the decrease of the mean particle size and the spreading shape of distribution could improve the mixing up to 30%.

SIGNIFICANCE / IMPLICATIONS:

- This study provides information and data about the design and optimization of the fluidized bed biomass gasification for syngas production.