Scaling Up of Carbon Fiber Furnaces

Increasing the production capacity and process efficiency of carbon fiber plants requires larger, faster and more energy efficient furnaces. The main technical challenges are:

- Understanding the process of off-gas mixing with the nitrogen cover gas into purge gas which critically affects the fiber properties.
- Maintaining uniform temperature and atmosphere conditions across the width of the furnace in order to ensure uniformity of the resulting properties of carbon fiber.

Project Approach

Develop parametric computational models for carbonization and gas flows inside the carbon fiber furnace. The developed model will be used to investigate various design strategies for scaling up carbon fiber furnaces.

The models will integrate the kinetic thermochemical model of the fiber carbonization process and the three-dimensional computational fluid dynamic model of mixing of off-gases from carbonization and purge gas.

Expected Benefits from the Project

- Evaluation of various approaches for increasing the size, capacity and efficiency of carbon fiber furnaces.
- Improved understanding of the underlying physical, chemical and thermal processes in the carbon fiber furnaces.
- Enabling material cost reduction necessary for increased use of CFRP in automotive industry.
- Increased ability to control the process conditions in the furnace.
- Current ‘state of the art’ 1500TPY carbon fiber line uses 30kW of energy to produce 1 kg of fiber
- A scaled up line capable of making 10,000 TPY from a current 1500 TPY will result in more than 50% of energy savings.