Carbon Particle Generator

6	24
C	Cr
Carbon	Creations
12.011	51.9961

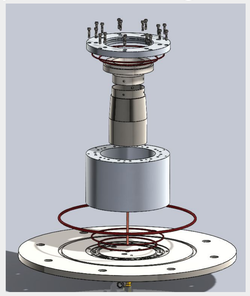
Overview

The Combustion and Solar Energy Laboratory is in need of a more efficient Carbon Particle Generator. This CPG must use a liquid fuel such as decane to generate carbon microparticles, about 1 micron in diameter, for solar energy absorption. Utilizing a liquid fuel for this process requires very high temperatures and pressures, posing an engineering challenge.

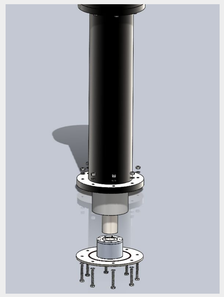
- **Sponsor:**
  SDSU College of Engineering
- **Advisors:**
  Dr. Fletcher Miller
  Dr. Scott Shaffar
  Mike Lester/Max Chang

Design

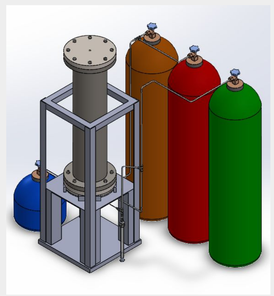
We designed and manufactured a flat flame burner that attaches directly to the bottom of the preexisting pressure chamber. This burner is supplied decane by a bubbler/reservoir system designed to nebulize the decane, which aids in pyrolyzation. To achieve a viable operating temperature a closed loop cooling system was designed.



Exploded View of Burner



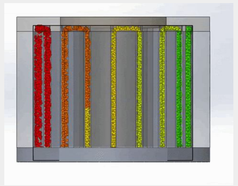
Exploded View of Pressure Chamber



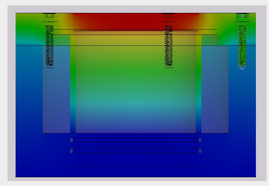
Full Assembly

Analysis

Throughout the year many studies were completed to ensure that our system functioned with the best efficiency possible and met all the requirements. Below are some examples of analyses made using SolidWorks.

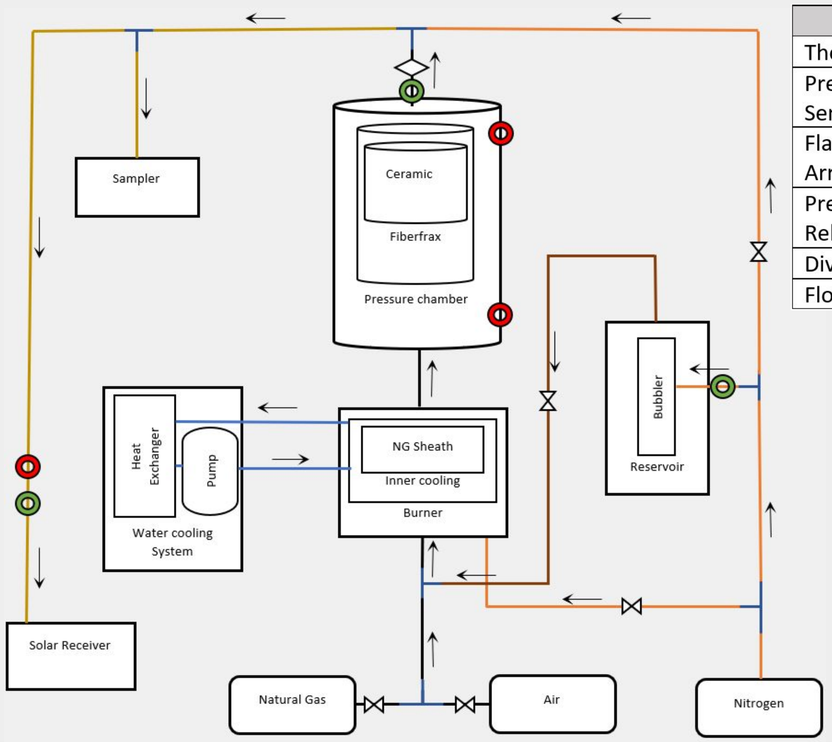


Head loss through serial cooling channel



Burner temperature gradient due to flame

System Level Diagram



Legend	
Thermocouple	
Pressure Sensor	
Flashback Arrestor	
Pressure Relief Valve	
Divider	
Flow Direction	

Team Members

Ali AlQattan

Ricardo Camacho

Cesar Telles

Edward Tomassone

Brandt Walton

Fabrication

During fabrication we used various tools like the CNC machine, water jet, and power tools to complete our project.

Requirements

- Carbon particles shall be produced by pyrolyzing liquid decane.
- Carbon particles shall have a spherical geometry.
- System shall operate for a minimum of 3 hours.
- Carbon particle temperatures shall be around 200℃ at outlet.
- Carbon particle size shall be within 0.5-1μm.

Spring 2021