Kenya Jiko Stove Modification: Exploring the Adsorptive Capabilities of Ceramics

Overview
The Kenya Jiko stove is a widely used clean cookstove in the Sub-Saharan region of Africa; however, millions of people are subject to premature death due to inhalation of noxious emissions from the combustion of biofuel in their homes. In an attempt to reduce this exposure, this project aims to explore the adsorptive capabilities of ceramic materials as a way to assess their potential for capturing such emissions, like Carbon Monoxide, Nitrous Oxides, and other particulate matter. Customer needs were assessed based on scholarly research and information provided by our sponsor and other colleagues in the field.

Objectives
- Develop a ceramic enclosure for the Kenya Jiko stove
- Utilize materials only found in Kenya to simplify manufacturing process and minimize supply chain.
- Ensure design is compatible with current cooking practices is convenient to use.
- Minimize cost to incentivize adoption of device; < $8 is ideal
- Help improve indoor air quality by decreasing exposure to toxic emissions
- Ensure device can be paired universally with any Kenya Jiko Stove.
- Explore adsorption capabilities of ceramics

Approach
- Observe the standard operation of the Kenya Jiko stove
- Identify flaws and potential for improvement
- Research and identify customer needs and requirements
- Search for clean cookstove patents and existing products
- Sketch potential solutions and generate CAD drawings
- Run BET Surface Area and pore size distribution tests at the Material Characterization Lab.
- Construct prototype with clay in ceramics studio.

Outcomes
- One Modular Cookstove Enclosure prototype was constructed out of standard red clay.
  - Device remained two separate pieces due to manufacturing difficulties
  - Pore size distribution tests determined that the conical hood can theoretically capture only 0.02% of carbon monoxide if it is the only product of combustion.
- Device does not hinder common cooking practices and is convenient to use.
- Device is too heavy, and alternatives to the material selection for the base should be explored, as well as methods for increasing ceramic pore size by incorporating sawdust prior to firing in the kiln.