Suppressing Coffee Smoke

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At-Home Coffee

Benefits:
- Fresher taste
- Saves money
- Flavors tailored to you
- More Sustainable

Consequences:
- Smoke generation

Coffee smoke contains primarily particulate matter (PM), volatile organic compounds (VOCs), organic acids, and combustion products.

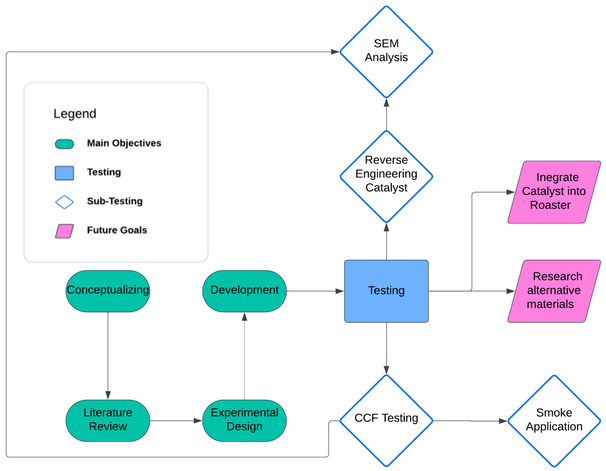
Eliminating Smoke

Ideal Outcome:

- Counter-top coffee roaster that produces no smoke

Objectives:

- Identify existing smoke suppression systems
- Perform material analysis
- Determine operating conditions



Reverse Engineering an In-Home Smoker

- Deconstruct the system
- Determine catalytic afterburner process
- Isolate the catalyst
- Evaluate operating conditions

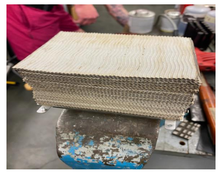
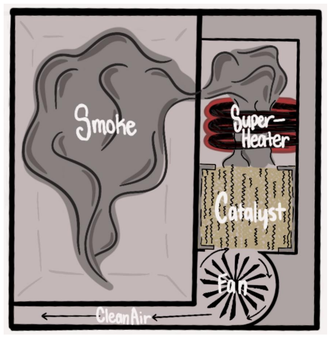


Diagram of Smoke Process



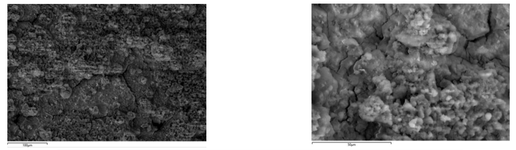
Ceramic Catalyst Filters

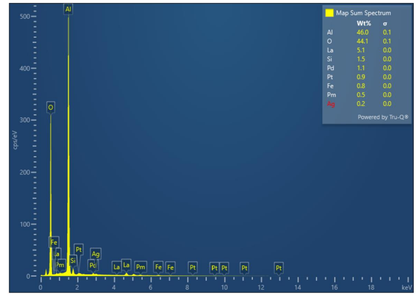
Ceramic Catalyst Filters (CCFs) contain candle-shaped ceramic filters with 90% porosity and lightweight refractory fibers that contain organic and inorganic binding agents. The fibers allow for high internal surface area and excellent thermal resistance. The catalytic slurry facilitates reactions to remove harmful chemicals in smoke.

CCF inside of a 3D printed mold after coffee smoke has passed through the filter

SEM Analysis

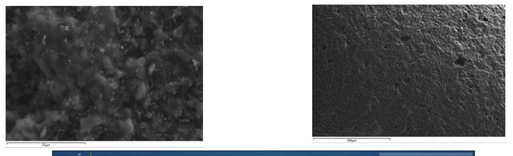
Catalyst:

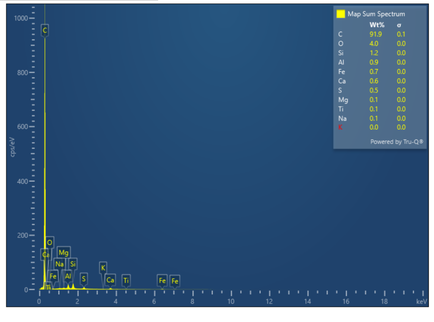




SEM imaging indicates the presence of Platinum and Lanthanum on the surface of the smoker catalyst

CCF:





SEM imaging indicates the primary element present on the CCF fibers as Carbon

Accomplishments

- Identified a working smoke elimination catalyst
- Evaluated the afterburner operating conditions
- Successfully disassembled and modified an existing in-home smoker
- Roasted quality coffee beans

Future Work

- Integrate the Catalytic Afterburner into the Roaster
- Test alternative catalyst materials to compare effectiveness
- Determine specific operating conditions for the catalytic afterburner

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