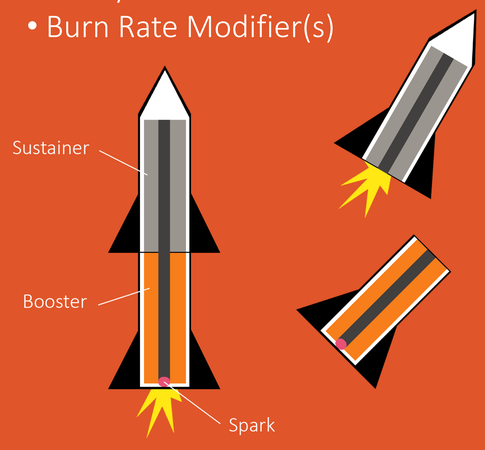
HIGH ALTITUDE ROCKET TEAM
ChE FUEL

Recipe Development

Fuel recipe is developed in two parts: booster and sustainer.

Components

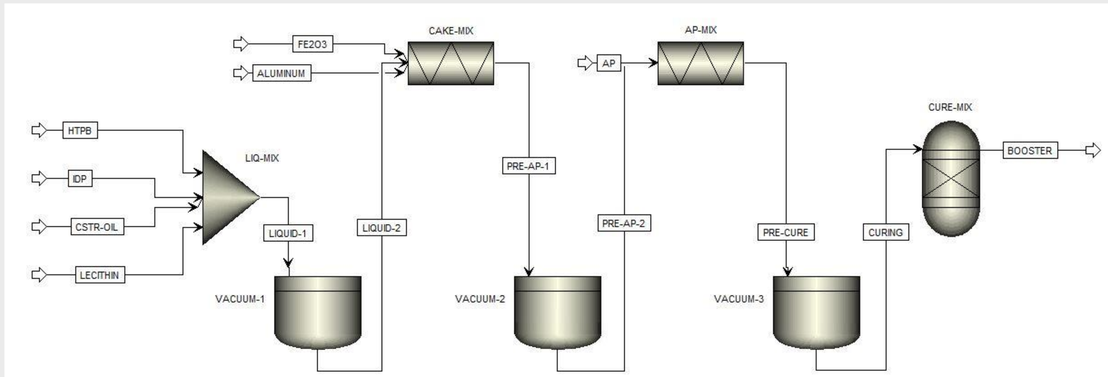
- Fuel
- Oxidizer
- Polymer
- Crosslinking Agent
- Solubility Modifier
- Emulsifier
- Plasticizer
- Catalyst
- Burn Rate Modifier(s)



Methods

Starting with a previous recipe, the team identified mixing interactions between the components and determined energetics using modeling software ProPep and Aspen Plus.

Objective: Optimize the solid-fuel propellent recipes to attain maximum altitude with the two-stage rocket.



Results

Using chemical processing software Aspen Plus, the team built a model of the mixing process. This has provided the team with theoretical data that is compared with experimental data from static fire tests.

Booster

The purpose of the booster fuel is to maximize the initial thrust from launch elevation. Red iron oxide is added to create a thermite reaction with the aluminum fuel which greatly increases the burn rate.

Sustainer

The goal of the sustainer fuel is to maintain thrust to maximize the altitude. Oxamide and carbon black are added to create endothermic reactions to decrease the burn rate and increase the burn time.

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Relevant Questions

What makes a good solid-fuel propellent?

Specific impulse, thrust, burn time, density, heat of combustion

How are the kinetics of the reaction controlled?

The kinetics are altered by the addition of burn rate modifiers.

Photo by Andrew Larson

Photo of booster fuel packed into cardboard casting tubes lined with an inhibitor to prevent excessive burning.

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