RV College of Engineering, Bengaluru – 560059.
Title: Field Analysis of varying Rocket Propellant Compositions

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Theme: Energy

Introduction

Solid rocket propellants are a crucial part of today's world, be it from rocket boosters, ejection seats, sounding rockets, etc. As part of this EL we have built a rocket motor, a static fire stand, developed a new propellant composition and a website for live data transmission from the hot-fire test.

Problem Definition

To understand how variations in fuel composition affects factors such as Thrust curve, total impulse, burn rate of grain and stability. Understanding these parameters and the best conditions for these factors will enable us to create a better, more efficient solid rocket fuel.

Objectives

1. To build testing apparatus and a solid rocket engine from scratch.
2. Regulated Experimentation with various solid propellants.
3. Developing a python program to help with designing a solid rocket motor.
4. Getting telemetry data on a Localized IP address.
5. Computing Specific Impulse from Obtained Thrust Curves.

Methodology

Simulations

3D - Model

Manufacturing Hardware

Coding

Fuel Manufacturing

Testing
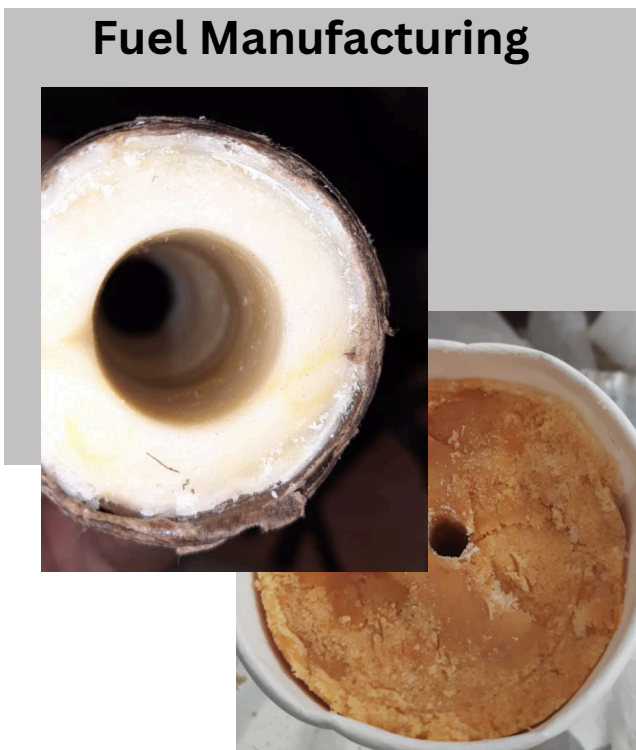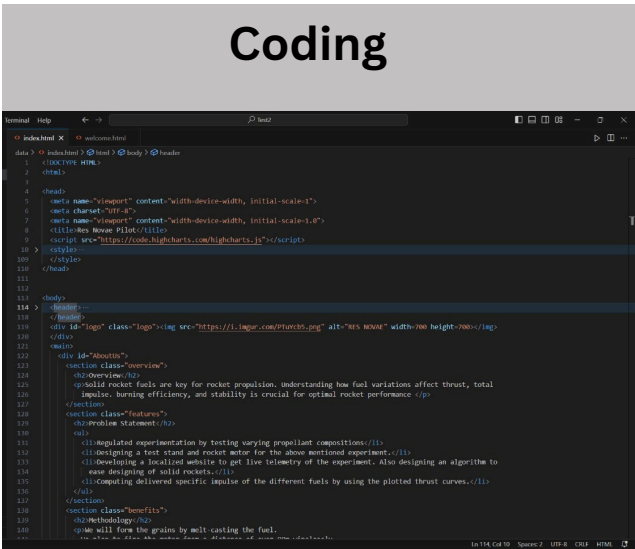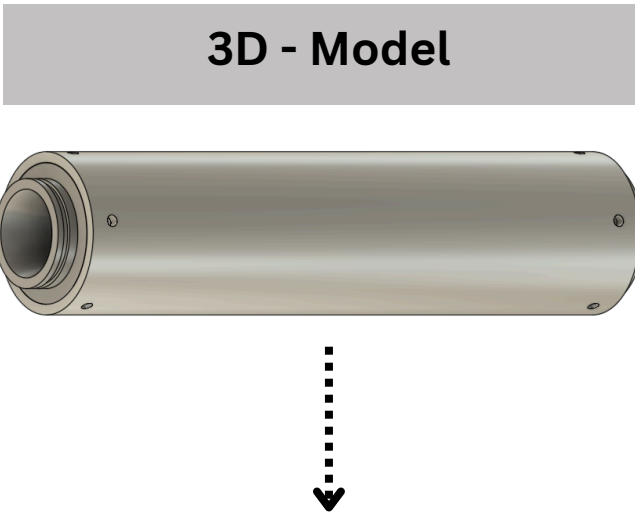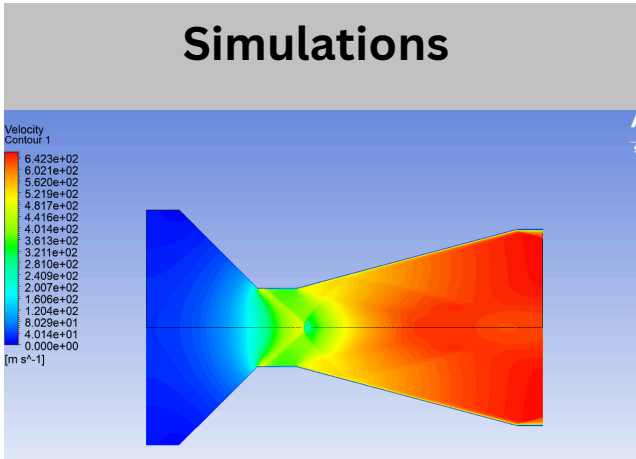
Tools used

Software:

1. ProPEP
2. Fusion 360
3. Ceetak O-Ring calc
4. Ansys Fluent
5. Arduino IDE
6. JavaScript, Python

Hardware:

1. Load Cell
2. Nozzle, Casing, Closure
3. O-Ring, 12.9 bolts
4. Aluminum Extrusions
5. Mild steel square

Chemicals:

1. Potassium Nitrate
2. Dextrose
3. Nano Aluminum Oxide
4. Ferric Oxide

Results and Discussions

- We were successful in manufacturing and testing our very own Solid rocket motor.
- We were also able to successfully cast and test Potassium nitrate (65%) - Dextrose (35%) [KNDX] propellant.
- We prepared Alumina nanoparticles (Al np) by solution-combustion method.
- We were able to run surface characterization on 2 experimental propellant compositions.
- We observed the role of alumina nanoparticles in Fuel-Oxidizer Binding.

Conclusions

- Our rocket motor worked perfectly and safely.
- The testing apparatus stayed grounded.
- We observed that Aluminum Oxide Nanoparticles, while creating a better burn surface, does hinder the binding of oxidizer and fuel which leads to weaker grains.
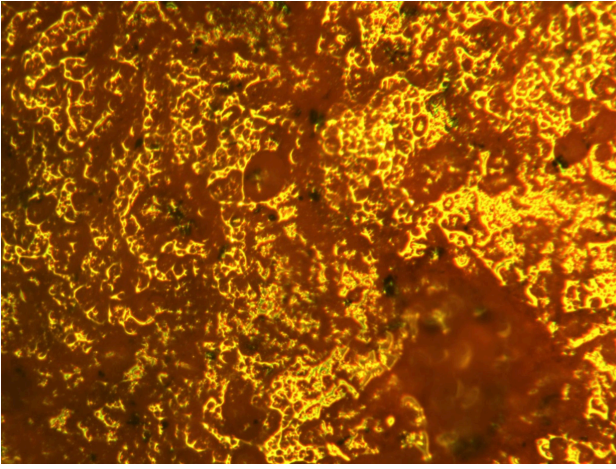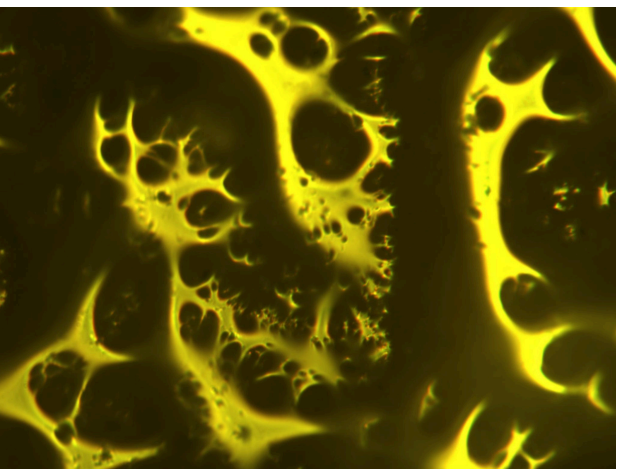
References

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