Investigation of thermal protection systems for hybrid rocket motors

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INTRODUCTION

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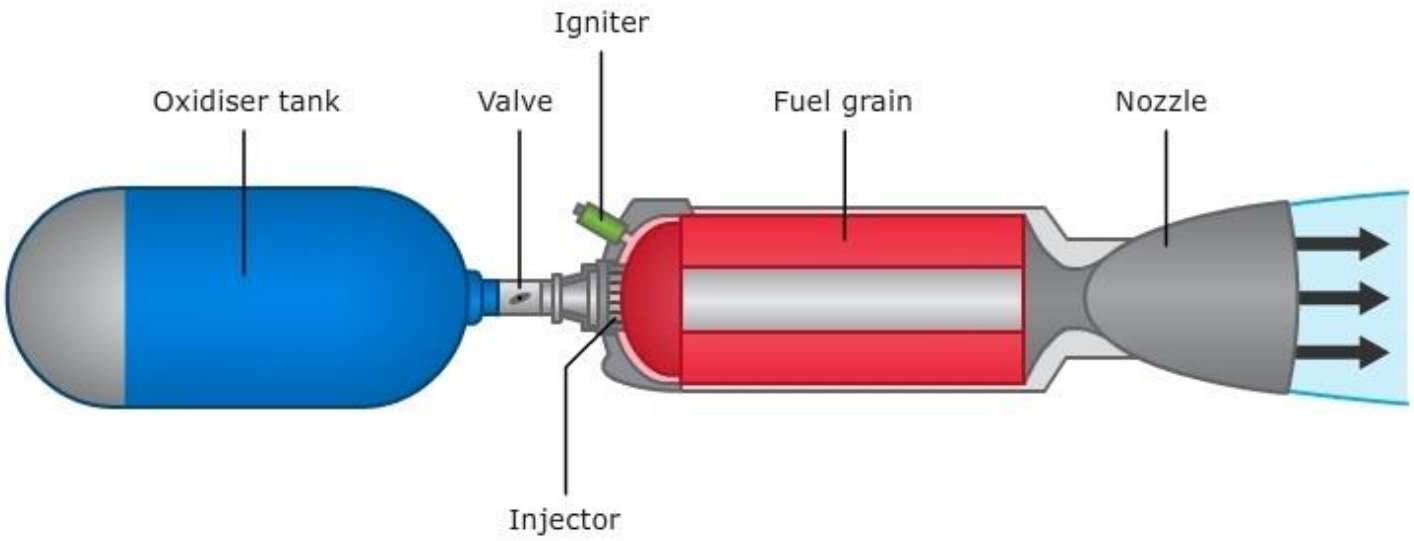
Introduction - Hybrid Rocket Motors



Advantages

- Safety
- Low costs
- Simplicity
- Green propellants
- Oxidizer flow control
  → Mission abort and throttlability

Main characteristics

- Oxidizer stored liquid in the tank
- Fuel stored solid in the combustion chamber
- One controllable feeding line
- Different technological solutions and propellant formulations

Disadvantages

- Low regression rates
  → Low volumetric efficiency
- Combustion efficiency
- High oxigen content in the exhaust

CISAS knowledge

- Introduction
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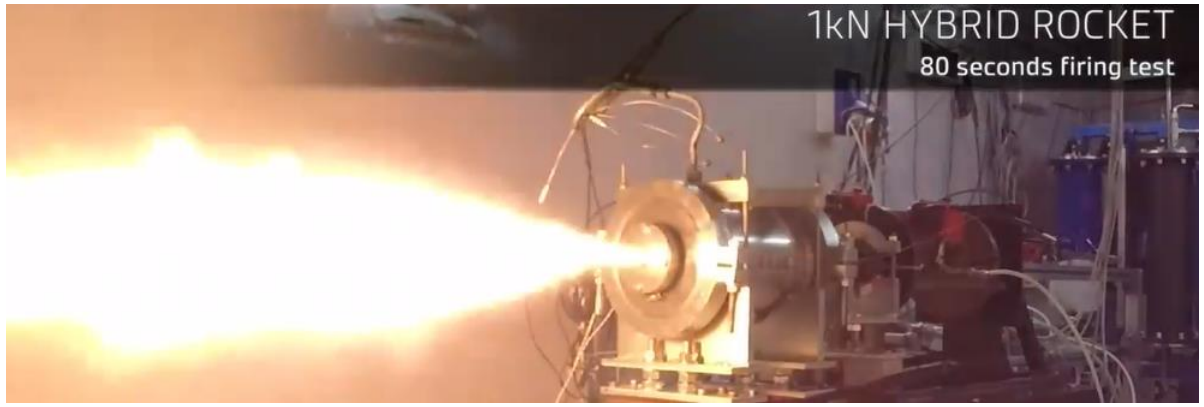
CISAS Knowledge

- ✓ Equipped test facility
- ✓ Great experience with hybrid rocket motors
- ✓ Use of HTP as liquid oxidizer
- ✓ High combustion efficiency
- ✓ Different scale motors: from 1 up to 10 KN
- ✓ Throttleable motors



Phd project

- **Introduction**
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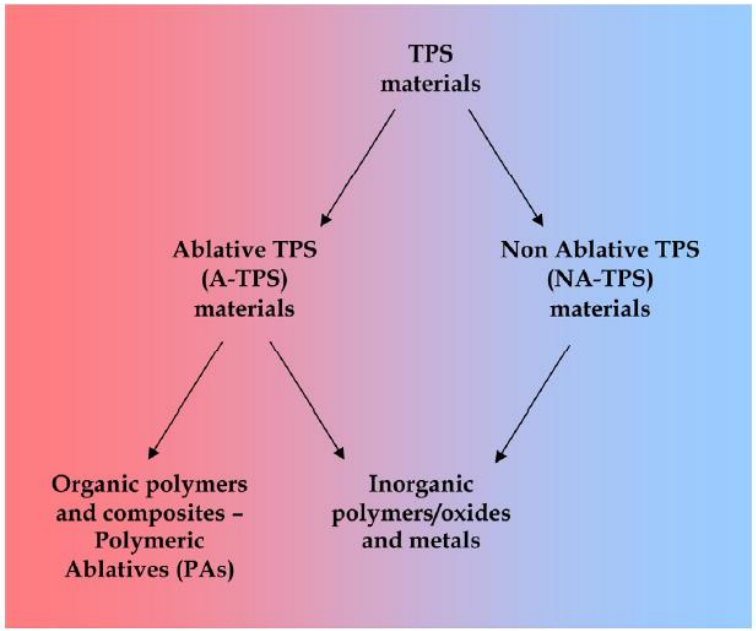
Phd project

Limit of the current technology:
impossibility to mantain high performances for a long time burn firing because of the
eccessive comsumption of the actual materials

The design of new thermal protection systems is needed

Why is it innovative?



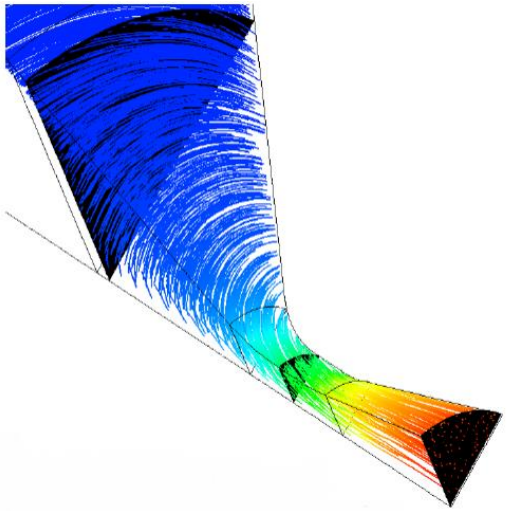
Ablative materials are already widely used in solid rocket motors, BUT there are many differences with hybrid rocket motors:

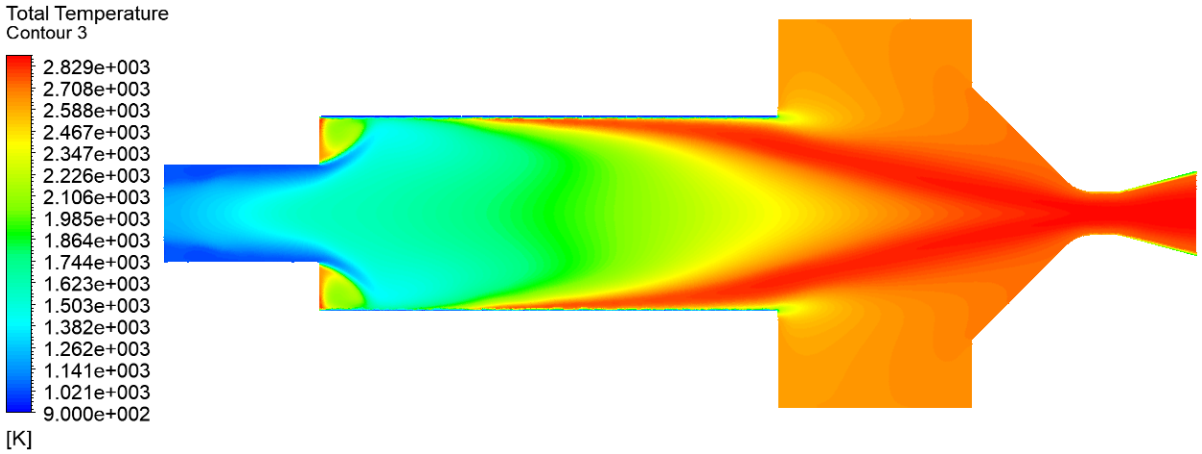
- ❑ Higher level of oxygen
- ❑ Lower pressure
- ❑ Lower temperature
- ❑ Must be cheap
- ❑ Possibly suitable also for a restart of the motor

Poor literature about this topic…

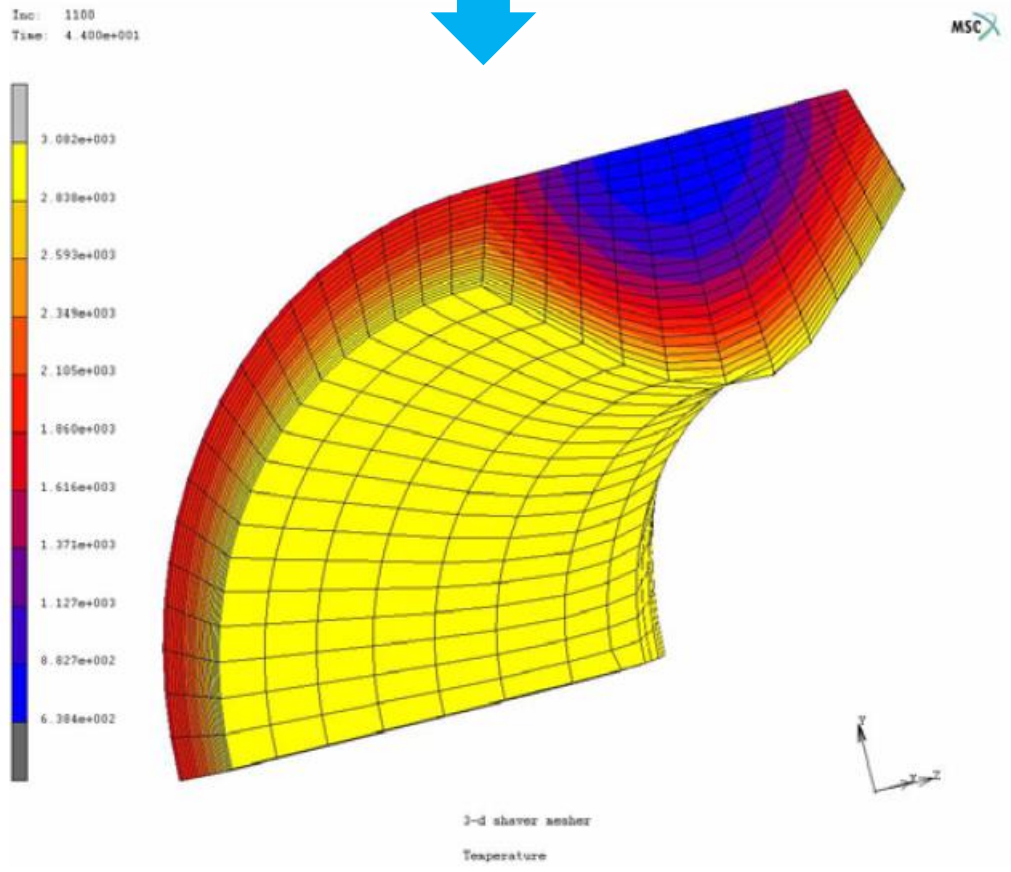
Methods of analysis

CFD





FEM



FIRE TESTS

Thank you for your time! Any questions?