SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution**)**

COIMBATORE–35

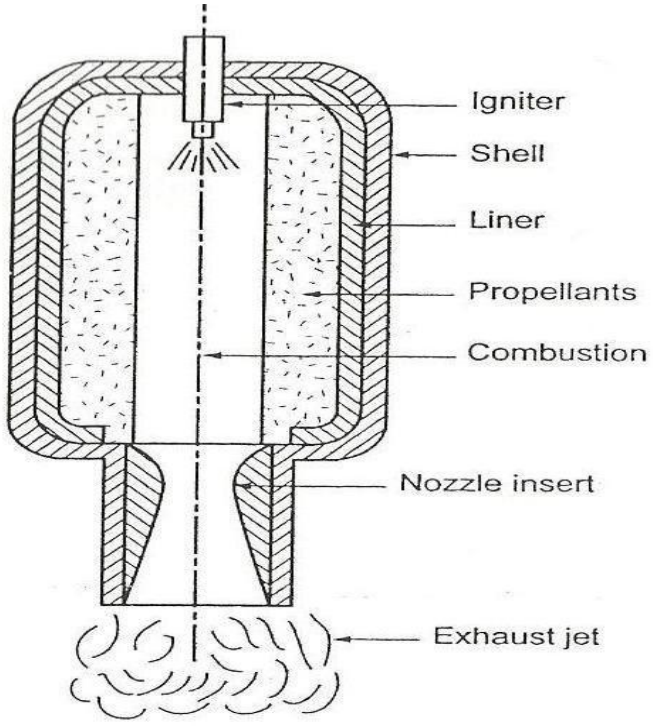
DEPARTMENT OF AERONAUTICAL ENGINEERING

ROCKET PROPULSION

CHEMICAL ROCKET ENGINES

SOLID PROPELLANT ROCKET ENGINE

Construction



SOLID PROPELLANT ROCKET ENGINE

- Solid propellant is the combination of solid fuel (plastic or resin material) and oxidizer (nitrates, perchlorates,etc)
- Solid fuel and oxidizer are homogeneously mixed and packed inside theshell.
- A liner is provided between the shell and the propellant. The purpose of liner is to protect the shell because high temperature will be generated during combustionprocess.

Working

- The igniter located at the top and ignites the spark. So combustion takesplace,
- When the combustion takes place in the combustion chamber, very high pressure and very

high temperature gases areproduced.

- The highly heated products of combustion gases are then allowed to expand in the nozzlesection.
- In the nozzle pressure energy of the gas is converted into kinetic energy. So the gases coming out from the unit with very high velocity.
- Due to high velocity of gases coming out from the unit, a force (or) thrust is produced in opposite direction. This thrust propels therocket.

Advantages

- Simple in design andconstruction.
- They do not require feed system. So they are free from the problems of moving parts such as pumps, valves,etc.
- Less vibration due to absence of movingparts.
- Lessmaintenance.
- Suitable for short rangeapplications.
- Problems arising from the sudden emptying of propellant tanks areabsent.

Disadvantages

- In case of emergency it is difficult to stop the engine in the mid way.
- Decrease of speed is notpossible.
- Low specificimpulse.
- At the end of an operation the burnt up debris cannot be reused. So it is uneconomical.
- Nozzle cooling is notpossible.
- Nozzle erosion is unavoidable due to the presence of solid particles in the high temperature and high speedgases.
- Transportation and handling of these rockets before firing require greater care due to the presence of propellantsthroughout.

SOLID PROPELLANTS

Solid propellants are classified into the following two groups.

(a) Heterogeneous (or) compositepropellants.

(b) Homogeneouspropellants

HETEROGENEOUS PROPELLANTS

In heterogeneous solid propellants, plastics, polymers and polyvinyl chlorides are used as fuels. Nitrates and perchlorates are used as oxidizers.

HOMOGENEOUS PROPELLANTS

In homogeneous solid propellants, nitroglycerine and nitrocellulose are used. It combines the properties of fuels and oxidizers.

PROPERTIES OF SOLID PROPELLANTS

- It should release large amount of heat duringcombustion.
- Physical and chemical properties should not change duringprocessing.
- It should have highdensity.
- It should not be poisonous andhazardous.

- It should be cheap and easilyavailable.
- It should be non-corrosive and non-reactive with components of theengine.
- Storage and handling should beeasy.