

Topic : Propellants

Subtopic : rocket propellant

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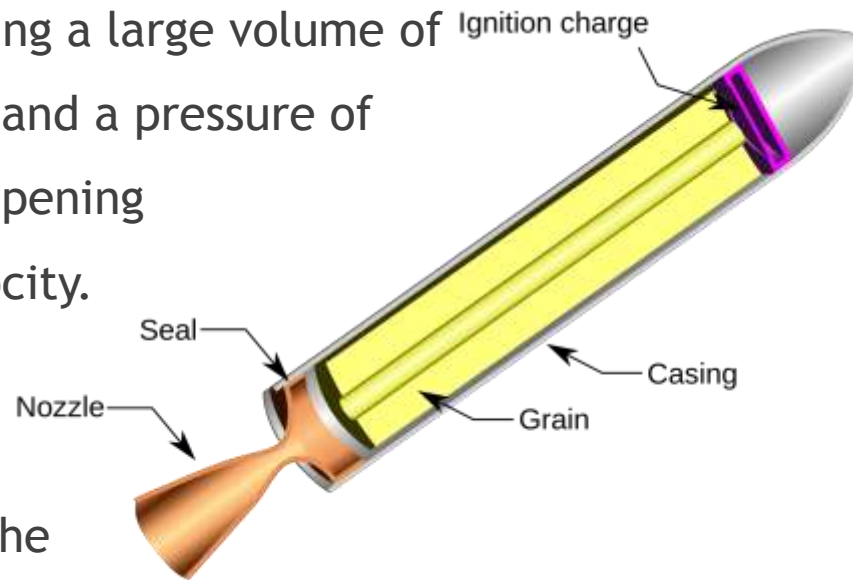
Rocket propellant

1) What is rocket propellant ?

- ▶ Rocket propellant is either a high oxygen containing fuel or a mixture of fuel and oxidant , whose combustion taken place , in definite and controlled manner with the evolution of large volume of gas.

2) How does it work ?

- ▶ a propellant reacts quickly , producing a large volume of gases(usually at a temperature of 3000 c and a pressure of 300 kg/cm²)which exit through a small opening (called jet or nozzle) at super sonic velocity.
- ▶ This act of pushing the backwards produces a equal and opposite reaction (newtons third of motion) which moves the rocket forward.
- ▶ With the increase in velocity , the rocket performance increase.



Classification of propellant

- ▶ 1) solid propellant
- ▶ 2) liquid propellant

▶ 1) **solid propellants** may be homogenous or composite.

A) Homogenous solid propellant :

- ▶ solid propellant or mixture of propellant is thoroughly mixed in a colloidal state
- ▶ When a single propellant is employed , it is called single based propellant
- ▶ For example : nitro cellulose
- ▶ Rocket propellant which contains two material , it is called double bases propellant
- ▶ For example : ballisite (mixture of nitrocellulose and nitroglycerine)
- ▶ Cordite(mixture of 65% nitrocellulose 30% nitroglycerine 5% petroleum jelly)
- ▶ General composition of double base propellant is 50 to 55% nitrocellulose and 40 to 45% nitroglycerine

- ▶ Diphenylphthalate , upto 5 % is also added which acts as a solvent cum plasticizer , thereby giving a homogenous plastic mass , which can be work smoothly.
- ▶ In addition to it , upto 1% diphenyl amine is added , which acts as a stabilizer.
- ▶ Such propellant gives flame temperature of about 2700c and volume of gases is about 1500 times the original volume.

B) Composite solid propellant

- ▶ When an oxidising agent is dispersed in a fuel mass , the solid propellant is called heterogeneous or composite.
- ▶ Ex. Gun powder
- ▶ It gives a flame temperature of 800- 1500c and volume of gases is about 400 times the original volume of charge.

► Other solid composite propellant are

75% potassium perchlorate + 25% asphalt oil

80% ammonium perchlorate and 20% resin binder

46% ammonium picrate and 48% sodium nitrate

► In selecting the oxidizer, it should be seen that it is non hygroscopic, stable in contact with fuel and does not form any corrosive product.

Advantages

- ▶ One advantage, is the ease of storage of solid propellant rockets.
- ▶ simplicity and low cost make solid propellant rockets ideal for military applications.
- ▶ Their simplicity also makes solid rockets a good choice whenever large amounts of thrust are needed and cost is an issue. The [Space Shuttle](#) and many other orbital [launch vehicles](#) use solid-fueled rockets in their boost stages ([solid rocket boosters](#)) for this reason.

Disadvantages

- ▶ Solid fueled rockets are relatively simple rockets. This is their chief advantage, but it also has its drawbacks . Once a solid rocket is ignited it will consume the entirety of its fuel, without any option for shutoff or thrust adjustment.
- ▶ Relative to liquid fuel rockets, solid fuel rockets have lower specific impulse(impulse delivered per unit of propellant).

Thank you