Advanced Ion Propulsion using Krypton Isotope for Rocket Engine

R. Saro
Dept of AERO-PITS

C. Madeshwaran
Dept of AERO-PITS

Mr. V. Keerthivasan
Assistant Professor
Dept of AERO-PITS

Mr. T. Anbarasan
Head of the Department Dept of AERO-PITS

Abstract:- **A Rocket engine is a storage device of rocket propellant which forms a high speed propulsive jet of fluid with a high temperature gas. Krypton isotope are used for producing hot positrons. Isotopes are obtained using neutron that produce reactors. The positrons were generated and directed towards action which on further obtain fusion propulsion. Positron dynamics reduce the speed of positron that are generated. It consists of moderator device with several layers of silicon carbide film which provide individual positrons. An electric field makes the particle to move towards each layers where the particles are cooled. The catalysed fusion reaction of positron is in a block of deuterium. When the particle triggers with deuterium, it produces thrust.**

Keywords – Positrons, Silicon carbide layer, Deuterium, Neutron capture.

INTRODUCTION

The word propulsion refers push forward or to move an object forward. A propulsion system has a mechanical power which converts power to propulsive force. Normally, this system consists of two classifications – air breathing and non-air breathing engine. In air breathing engine, it is sub- classified into gas turbine and non- gas turbine engine and in non-air breathing engine it is sub-classified into rocket engine.

Rocket engine is a storage device of rocket propellant which forms a high speed propulsive jet of fluid with a high temperature gas. It produces thrust using newton's third law. It uses combustion of chemicals to supply energy. It has own oxidizers. The vehicles using rocket engines are called rocket. These engines can also be used in vacuum for spacecraft and missiles. In chemical rocket engine hot exhaust gases are produced by chemical combustion. The fuel and oxidizers are two types of chemical propellant in rocket engine. Both propellants are required for combustion.

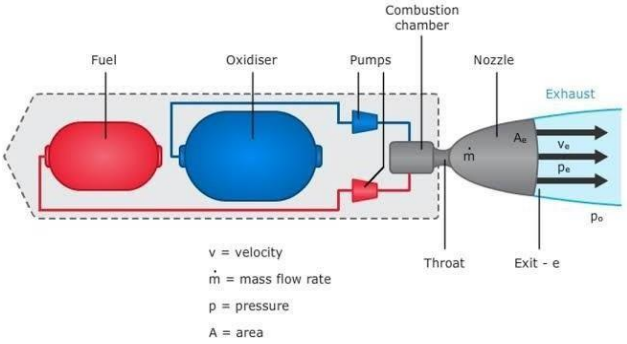

FIG .1.1-ROCKET ENGINE

ADVANCED PROPULSION

Spacecraft has been slow down due to chemical rocket speed over years. Only speed over 1 million miles per hour is possible over the year 2050. New ion drives as being developed to provide ten times better than ISP. In accordance to ion drives, krypton isotopes are used has ion for producing hot positrons. These isotopes are obtained using neutrons that produce reactors. The positrons where generated and directed to obtain fusion propulsion.

FUSION PROPULSION

Fusion propulsion is driven by a rocket. It has more efficiency and acceleration in space without any large amount of fuel requirement. The construction of rocket is large and complex than other spacecraft. Currently, the development of fusion power technology is beyond capability. The main advantage of fusion very high specific impulse and disadvantage is mass of reactor is more. A fusion rocket emits less radiation than fission rocket.

IONIZATION ENERGY

Ionization energy is the minimum amount of energy required to remove the electron. The obtained is said to be isolated neutral gaseous atom or molecule. If an electron removed from any atom or molecule, it forms as endothermic process. Endothermic process is a form of heat which absorbs energy from its surroundings.

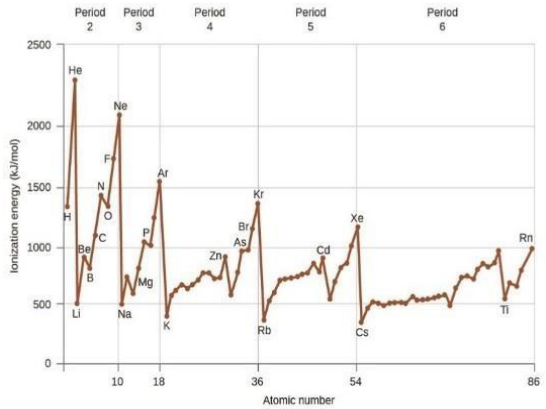

FIG .2.1.-IONIZATION ENERGY VS ATOMIC NUMBER

In ionization energy, the atomic number varies in the form of inert gases like xenon-54, krypton-36, argon-18, neon-10 and helium-2. In ionization propulsion, we use krypton has positron because it has less atomic number. If atomic number of an element is less it balances and helps to produce more thrust compared to chemical propellant.

POSITRON DYNAMICS

Positron dynamics the power generated by the rocket engine on the base of positron. Positron is otherwise named as positive electron where the positively charged subatomic particles having same mass as an electron with equal numerical value. These positron dynamics helps to reduce the speed of positron that are generated. A region consists of moderator device with several layers of coating. These positrons are sent to the moderator device. This device is measured in terms of 3*3millimeters. The atomic number of krypton is 36. Usually, isotope of krypton consists of stable isotopes namely krypton-78, krypton-79, krypton-80, krypton- 85, krypton-90 and so on. It has slight radioactive isotope that produce cosmic rays in atmosphere. The krypton-79 used as positron in this process. And the source is named as positron source.

MODERATOR DEVICE

Silicon carbide is nothing but a fuzzy fibre that make rocket engine stronger, lighter and also helps to withstand extreme heat produced by engine. It withstands temperature up to 1,600degree Celsius. Moderator device are used to extract individual positrons and the electric field causes the particles to drift towards each layer of silicon carbide, where the positrons are being cooled. This fusion reaction helps to transfer kinetic energy of gamma rays that produce positron into charged particles. These cooled positrons particles are triggered towards a block of deuterium.

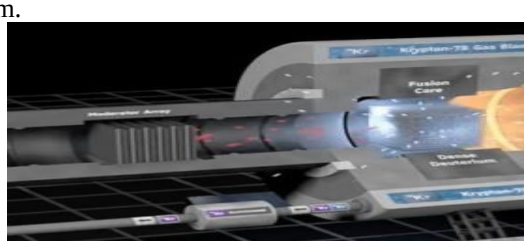

Fig .3.1.Moderator Device

DEUTERIUM

Hydrogen has more number of isotopes and deuterium is one of them. Deuterium has both proton and neutron. This isotope is heavier because it contains neutron and hence it is also known as heavy hydrogen.

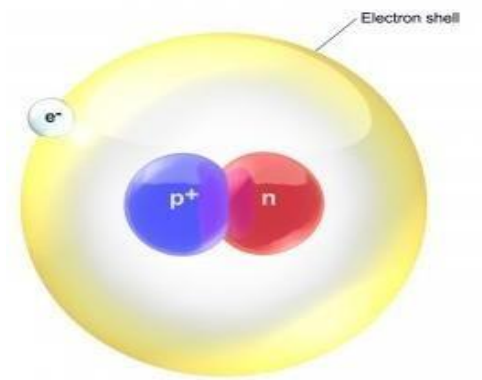

FIG .3.2.1-DEUTERIUM

The deuterium nucleus is also termed as deuteron. It has the atomic wait of 2.014 It is mainly used in prototype fusion reactor. It is used in a number of conventional nuclear reactors in the form of heavy water.

The region of deuterium is called fusion core. The positrons are triggered in the deuterium and leaves high efficiency of thrust. And on other hand the positron that triggered is converted into thrust on one way and in other way krypton element is sent to the starting position. i.e. positron source. Then the same cycle takes place randomly.

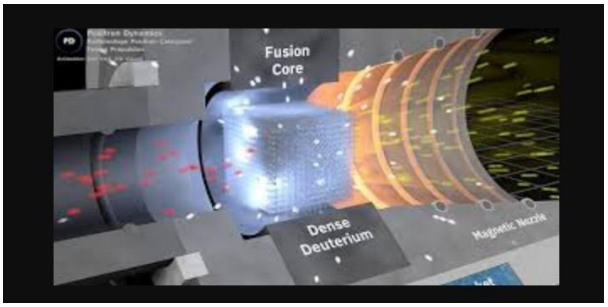

FIG.3.2.2- DEUTERIUM REGION IN FUSION CORE

RESULTS

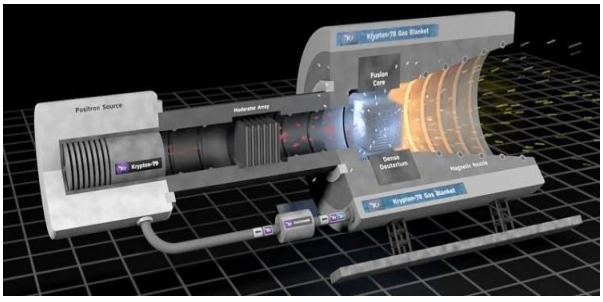

FIG.4.1-KRYPTON ISOTOPE- ION PROPULSION

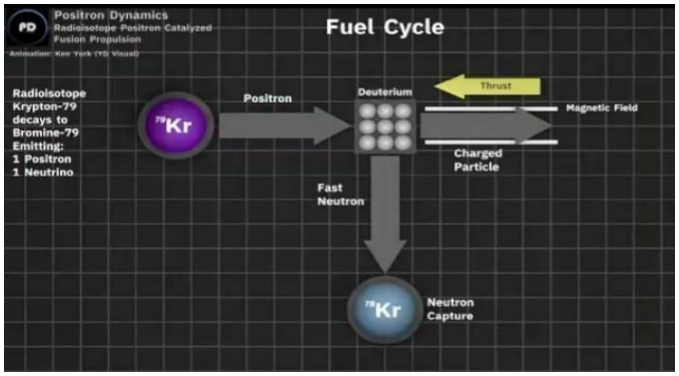

FIG.4.2-KRYPTON-79 TOWARDS DEUTERIUM

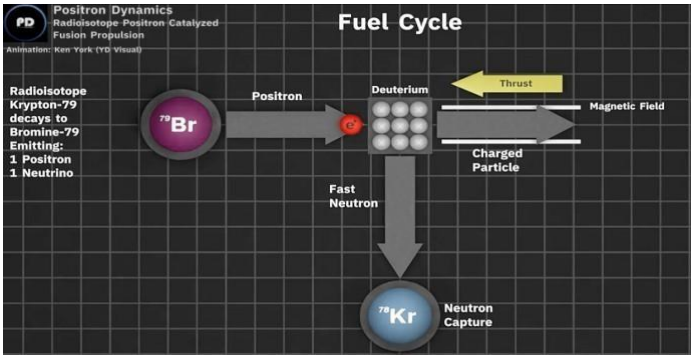

FIG.4.3-KRYPTON-78 ON NEUTRON CAPTURE

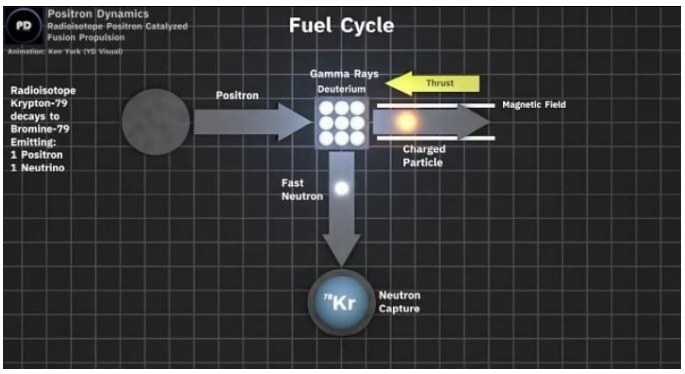

FIG.4.4-THRUST PRODUCED AFTER TRIGGERING

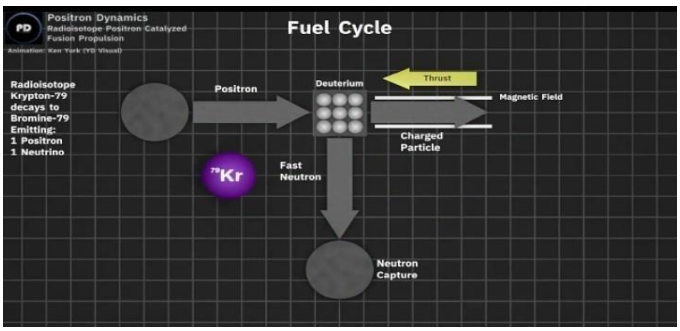

FIG.4.5-KRYPTON CYCLE BACKS TO POITRON

CONCLUSION

We have clearly analysed and learned about the krypton isotopes used as positron in rocket engine. Thus the results are shown in above figures.

1. Fig.4.1 shows the total configuration of ion propulsion using krypton as positron.
2. Fig.4.2 clearly explain the cycle through flow chart i.e. krypton-79 is emitted from positron source and move through the moderator device of silicon carbide layer which helps to cool the positron emitted.
3. Fig.4.3 explains that when one electron is removed from krypton-79 it becomes bromine-79 on positron source.
4. Fig.4.4 shows that when the positron gets triggered by the deuterium it tends to produce more thrust towards nozzle which is magnetized efficiently. On the other an electron of krypton-78 is emitted on neutron capture.
5. Fig.4.5 shows the final stage i.e. the krypton-78 goes back to the positron source which comes back to original position krypton-79 and the process is cycled continuously.

REFERENCES

[1] Smarsly W. Coatings for advanced aero engine materials. In: 8th High power impulse magnetron sputtering (HIPIMS) conference, University of Sheffield, UK; 1–2 July, 2009.

[2] Helm D, Roder O. Recent titanium research and development in Germany.

[3] Brendel T, Heutling F, Eichmann F, Ucker M, Uihlein T. MTU solutions against erosive attack and loss of EGT margin in turbo engines-ER coat. MTU technical publication; 2008.

[4] F.Yu and T.D.Bennett (2005). "A nondestructive technique for determining thermal properties of thermal barrier coatings". J. Appl. Phys. 97: 013520.

[5] Clarke, David R.; Phillpot, Simon R. (2005). "Thermal barrier coating materials". Materials Today. 8 (6): 22–29.

[6] Padture Nitin P.; Gell Maurice; Jordan Eric H. (2002). "Thermal Barrier Coatings for Gas-Turbine Engine Applications". Science. 296 (5566): 280–284