An Overview on Nuclear Fusion and Fission in Applied Physics

Andrea Nelson*

Department of Applied Sciences Indian Institute of Technology, Delhi, India

Opinion Article

Received: 25-Mar-2022 Manuscript No. JPAP-22-63918; **Editor assigned:** 28-Mar-2022 Pre QC No. JPAP-22-63918(PQ); **Reviewed:** 11-Apr-2022, QC No. JPAP-22-63918; **Revised:** 18-Apr-2022, Manuscript No. JPAP-22-63918(R) **Published:** 25-Apr-2022, DOI:10.4172/2320-2459.10.S1.002

***For Correspondence:**

Andrea Nelson, Department of Applied Sciences Indian Institute of Technology, Delhi, India

E-mail: Nelson.andrea@gmail.com

ABOUT THE STUDY

Nuclear fusion and fission are the processes by which the nucleus of an atom gains (fusion) or loses (fission) protons, transforming into a different type of atom. Both processes release energy. Nuclear fusion and fission occur in nature, for example, within a star, and artificially, for example in a nuclear reactor. Energy is released from the nucleus if the Nuclear Binding Energies of the nucleus is increased. Fusion is the process of combining the nuclei of smaller atoms(less protons & neutrons and hence, a smaller atomic number) to create a larger atom. In many stars, the process starts with hydrogen (H) atoms combining to form helium atoms (He) then combining again to form Beryllium (Be) atoms and so on... The process stops when all the atoms are converted to Iron (Fe) and the star is thus dead. The reason for this is that once the atoms reach Iron and higher, the energy required to fuse the atoms becomes greater than the energy released by the atoms.

More precisely, fusion is only favorable up to Iron since it is only up to this point that the energy per nucleon (proton and neutron) continues to decrease. The most efficient energy/nucleon reactions that can occur in the process of fusion are Hydrogen-Hydrogen reactions, or between various isotopes of hydrogen. For nuclei heavier than Iron, the tendency is for fission (see other section) to become more viable in terms of liberating energy, i.e. to reduce stored energy/nucleon.

Fusion occurs naturally in environments where a sufficiently large amount of matter is collapsed under gravitational pressure that atoms are stripped of their electrons and nuclei have a sufficiently low mean free path (i.e. their density is fairly high). The aggregate of matter forming such an object is then usually referred to as a star.

Since the yield from hydrogen fusion is actually higher than for uranium fission, the byproducts are largely benign (with the exception of high energy neutrons), and the materials can be readily obtained by electrolysis from a plentiful resource (water), it is natural to consider trying to build fusion power plants. Since the nuclei are charged, it is possible to control those using powerful magnetic fields, and this is the standard idea in trying to control hydrogen plasma in order to produce a sustained and controlled nuclear reaction. Although progress has been steady, considerable engineering obstacles still need to be overcome.

This is the breakdown of large, heavy nuclei, to make smaller, lighter, more stable nuclei with a lower energy state and release energy at the same time, this is the process used in creating nuclear weapons. A nucleus may split in many different ways, in fact it is very rare for an even split to occur, one "half" being larger than the other in most cases. the mechanism maybe something like this an unstable (large Neutron rich isotope)is held together by the strong nuclear force because it is unstable it distorts allowing the coulomb repulsion between the positive protons to overcome the strong nuclear attraction and separate them this forms two highly energetic halves. These may increase their stability by emitting neutrons; these are known as prompt neutrons. Other neutrons maybe emitted later these are known as not surprisingly delayed neutrons. There are two types of fission, the first is spontaneous (this happens without first absorbing a neutron) and more common neutron induced fission which is as its name implies.

CONCLUSION

For power generation only nuclear fission occurring in a chain reaction is of interest. It is performed controlled in a reactor and uncontrolled in a nuclear bomb. For running a chain reaction the absence of neutron captures and materials with fissionable nuclei are required. The only natural nuclei, which can be used for reactor operation is uranium235. Others like plutonium239 have to be created artificially, however also in a reactor, which requires a fuel like uranium235 or plutonium239. Interestingly a few billion years ago, building a reactor would have been much easier, as there was a much higher concentration of uranium235 in natural uranium.