



## 19CH101– ENGINEERING CHEMISTRY

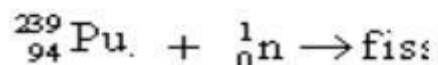
### Unit-5 ENERGY SOURCES AND STORAGE DEVICES

#### BREEDER REACTOR

A **breeder reactor** is a nuclear reactor that generates more fissile material than it consumes. Breeder reactors achieve this because their neutron economy is high enough to create more fissile fuel than they use, by irradiation of a fertile material, such as uranium-238 or thorium-232, that is loaded into the reactor along with fissile fuel. Breeders were at first found attractive because they made more complete use of uranium fuel than light water reactors, but interest declined after the 1960s as more uranium reserves were found, and new methods of uranium enrichment reduced fuel costs.

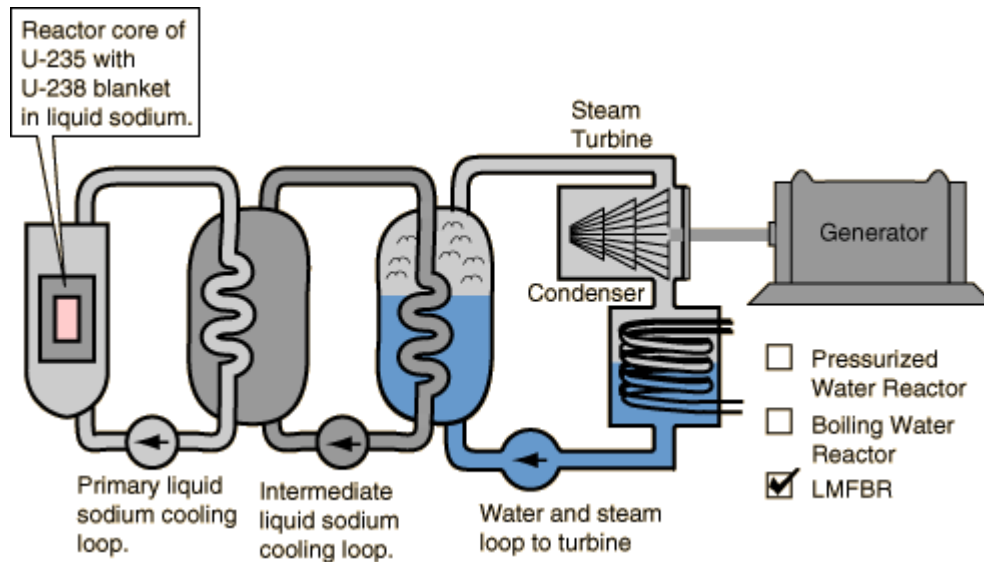
A nuclear reactor with conversion or multiplication factor greater than one is a breeder reactor.

A breeder reactor generates fissionable nuclei from fertile nuclei. E.g., the fertile material like uranium-238 is converted into fissile  ${}_{94}\text{Pu}^{239}$  by using slow neutrons.  ${}_{94}\text{Pu}^{239}$  undergoes fission and produces energy.



#### Working :

In breeder reactor,  ${}_{92}\text{U}^{235}$  is used as trigger to produce sufficient neutrons. These are used to convert  ${}_{92}\text{U}^{238}$  to Plutonium undergoes fission with the production of three neutrons. One neutron is used to propagate fission chain. The other two neutrons react with  ${}_{92}\text{U}^{238}$  to fissionable  ${}_{94}\text{Pu}^{239}$ . Thus breeder reactor produces two  ${}^{239}\text{Pu}$  atoms for each  ${}^{238}\text{U}$  consumed. Thus more fissionable material is produced than consumed. Hence the reactor is called breeder reactor.



### Critical Mass:

The minimum amount of fissile material ( $U^{235}$ ) required to continue the nuclear chain reaction is called critical mass.