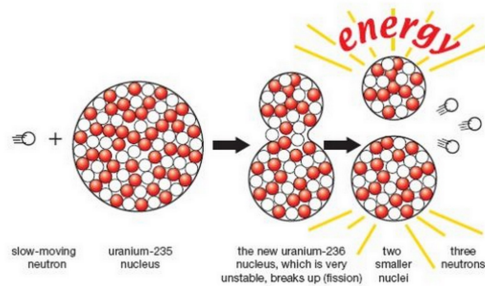


Nuclear Physics - Fission

05 March 2020 11:08

Fission



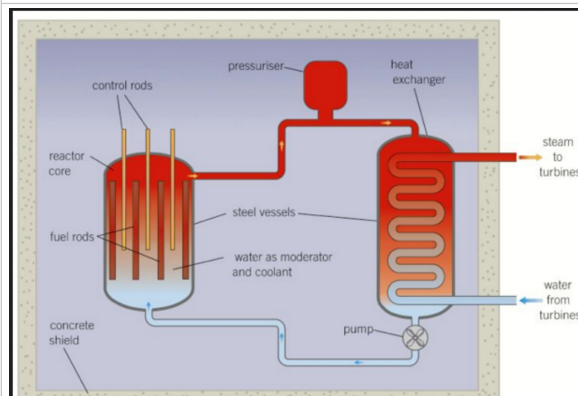
Fission of a nucleus of uranium-235

Nuclei with 89 or more protons are unstable - and some spontaneously, randomly split into smaller nuclei - spontaneous fission.

Induced fission is when a slow moving neutron (so no need to overcome a large repulsion) enters the large nucleus, causing it to be even more unstable and hence undergo fission.

Lots of energy is released because the smaller nuclei have a higher average binding energy per nucleon.

Note that the fission itself produces 3 neutrons. These neutrons might cause other fissions but they might be going too fast to be absorbed by other heavy nuclei. Slow neutrons are known as 'thermal neutrons'



In essence Fission reactors are quite simple.... It's just that if the worst should happen the consequences are quite enormous...

It is possible to control Fission and get lots of lovely energy.

- Fuel is rods of ^{235}U placed away from workers (even Homer)
- The neutrons produced by spontaneous fission can go on to cause other fissions provided they are slowed down in a 'moderator' like water.
- This energy is reduced by elastic collisions - and the molecules in the moderator need to have a mass close to that of the neutrons - hence water is a good choice.
- The mass of ^{235}U in the rods is important. If you have less than the critical mass the fissions peter out. So in reactors they have a 'supercritical' mass - ie more than the critical mass. This means a chain reaction is created.
- Control rods, made of a good absorber of neutrons (eg Boron) control the rate of fissions by absorbing neutrons - so you can slow it down by moving the rods down more between the fuel rods. In an emergency the rods can be fully inserted to absorb the neutrons.
- Coolant (also the moderator!) is circulated around and its heat is removed in the heat exchanger - where different water creates steam -> used to turn turbines
- Usually enclosed in a concrete shield.



The damaged reactor at Chernobyl was encased

The finished structure will weigh about 29,000 tons and stand 110m tall and 257m wide. It must be capable of withstanding temperatures ranging from -43C to 45C and has a predicted life span of 100 years. At 110m (360ft) tall, the structure could house the Statue of Liberty, and at 257m (843ft) wide, there would be room for a football pitch. There are acres of metal panels in the roof, to seal off the reactor and the dangerous mess inside. The whole lot will be held together by 680,000 heavy bolts.

Text: <<http://watchermeet-up.forumotion.com/t5371-chernobyl-s-arch-sealing-off-a-radioactive-sarcophagus-in-2015>>

Images https://en.wikipedia.org/wiki/Chernobyl_New_Safe_Confinement