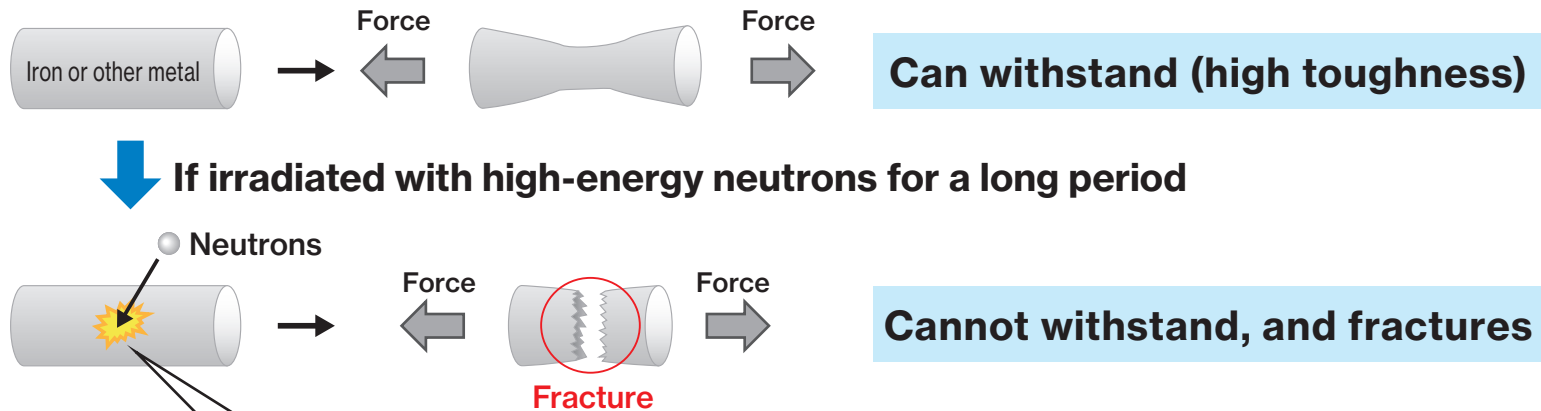


# About Neutron Irradiation Embrittlement

Metal doesn't fracture easily, even when a large force is applied. At high temperatures, it keeps this property of not fracturing easily (high toughness), but if its temperature is lowered, its toughness decreases. This phenomenon of toughness decreasing is called embrittlement. Metals like iron become brittle not only when their temperature decreases, but also when they are irradiated with high-energy neutrons. If we look at iron at the atomic level, the atoms are lined up properly in an orderly state which gives it high toughness, but if it's irradiated with high-energy neutrons for a long period, "knock-on" occurs in which some iron atoms are displaced leaving gaps, or some atoms become inserted between the other atoms. Also, in the iron of the reactor vessel, phosphorus, copper, and other substances that exist as impurities may clump together. When the atoms that were lined up in an orderly arrangement become disorderly, the toughness decreases and it is known as "neutron irradiation embrittlement".

## Visualization of metal toughness



## Visualization of atomic-structure changes accompanying neutron irradiation

