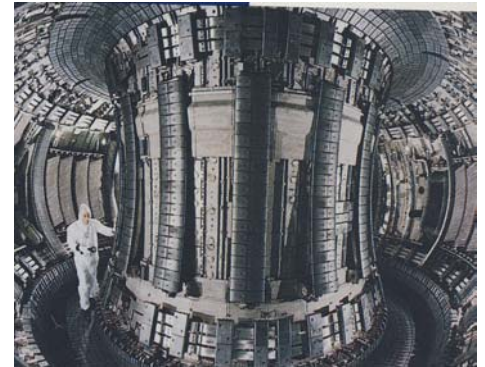


Industrial Applications

Nuclear Industry



Nuclear industry

Nuclear graphite

Nuclear Technology

Requirements for specialty graphite

Examples of Application



Nuclear graphite

The element carbon has the ability of slowing down fast neutrons without capturing them. Carbon is therefore a valuable material for the construction and operation of power reactors of various types ranging from the CO₂-cooled reactor with a cooling gas temperature of 400°C to the helium-cooled high temperature reactor with operating temperatures beyond 800°C. Only purified graphite can meet this special requirement combining strength and good neutron irradiation behaviour.



Nuclear graphite

This means that its mechanical or physical properties, e.g. strength or lattice constants, are not allowed to be strongly influenced or affected by irradiation.

This objective can be achieved by using isotropic graphite. For the manufacture of such isotropic graphite, either an isotropic coke is used as the starting material, or one has to exploit the opportunities of process engineering.

The fields of application in the reactor industry are widely varied and comprise the use of graphite as moderators and in fuel matrices, as reflectors in heavy-water reactors and as neutron shields in sodium-cooled fast-breeding reactors.



Nuclear technology

- Graphite finds widespread use in many areas of nuclear technology based on its excellent moderator and reflector qualities, which are combined almost uniquely with strength and high temperature stability.
- The function of a moderator is to slow fast neutrons to thermal velocities at which fission in Uranium-235 and Uranium-233 are most efficient.
- The reflector serves to reflect neutrons, which otherwise would escape, back into the active core region.
- Nuclear grade graphite was developed for fission reactors.



Nuclear Industry

Requirements for specialty graphite (depending on the nuclear application)

- fine-grain to ultra-fine-grain graphites
 - high to ultra-high chemical purity
- high mechanical strength
 - constant properties in accordance with specification
- good moderating ration
 - good surface structure
- small neutron absorption cross-section



Nuclear industry

- Examples of applications
 - tubes for the installation of fuel elements for nuclear power plants
 - graphite sheets
 - graphite lining for the torus
 - graphite protection for antennas in nuclear fusion reactors
 - specialty graphite components for the core structure
 - moderation spheres and blocks made from specialty graphites
 - graphite powder for the production of spherical fuel elements

