

Understanding the fracture of nuclear grade graphite with radiation damage and thermal heating

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Nuclear-grade graphite is often used as target materials in a particle accelerator; it is also used as moderator and structural materials in nuclear fission reactor cores in the UK as well as in some GenIV reactor designs. This work will provide an overview of the types of graphite materials used in these applications and will detail the differences in their microstructure and thermal-mechanical properties. These nuclear grade graphite materials will often shrink upon irradiation causing dimensional changes and subsequent stresses leading to fracture; but there are also exceptions where low temperature irradiation leads to swelling first at low dose. These will be discussed. When used with CO₂ coolant in a nuclear fission reactor, there is radiolytic oxidation reducing the density of the graphite. Details will be given in terms of the irradiation induced damages in these graphite materials and how their behaviours change with thermal heating to temperatures at 1100°C.

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