

The Analysis of Influence Factors on anisotropy of graphite matrix materials

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ABSTRACT:

The orientation of the graphite crystal structure determines its macroscopic thermodynamic anisotropy. The fuel elements for pebble-bed high temperature gas-cooled reactor (HTR) is spherical shape (Φ 60 mm) , with fuel particles dispersed in the matrix material. The smaller anisotropy of matrix material, which is composed of natural graphite, artificial graphite and glassy carbon, is beneficial to the safety of reactor.

Natural graphite, artificial graphite and phenolic resin are used as raw materials to produce matrix graphite powder by kneading, granulating, drying and crushing; the matrix graphite powders are then pressed, carbonized and purified to fabricate matrix graphite balls. In this work, the influences of powder morphology, pressing method, shape of soft die and feeding method on the thermodynamic anisotropy of graphite matrix materials are studied, which originates from the shape and force transfer characteristics of the soft die. The synergistic effect of graphite powder spheroidization and feeding percussion results in powders flowing in the charging process, which enlarged the difference of thermodynamic properties between horizontal and vertical directions.

This study also show that the matrix material could be almost isotropic by way of spheroidizing and isostatic pressing, which is of great significance to simplify the fuel element production and QC process, and improve the safety of reactor.