



Standard Guide for Impregnation of Graphite with Molten Salt¹

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1. Scope

1.1 This guide covers procedures for the impregnation of graphite with molten salt under a consistent pressure and temperature. Such procedures are necessary if the user wishes to prepare graphite specimens for testing that have been exposed to a molten salt environment that may not necessarily represent material exposed to an operating reactor environment.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this guide.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C559 Test Method for Bulk Density by Physical Measurements of Manufactured Carbon and Graphite Articles

D7775 Guide for Measurements on Small Graphite Specimens

3. Terminology

3.1 *Definitions:*

3.1.1 *impregnation pressure* (P_I), n —the pressure of cover gas used in the impregnation.

3.1.2 *impregnation temperature* (T_I), n —the system temperature before the graphite sample has been immersed in the molten salt.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *Parameter D*—provides a measure of the extent of penetration of the graphite porosity by the molten salt. If there

was no damage to the microstructure of the graphite during impregnation, then parameter D based upon open pore volume would be unity at saturation. At high impregnation pressures, closed porosity may be broken into by the molten salt and parameter D based upon open pore volume could have values greater than unity. It is therefore useful to express parameter D in terms of both open pore volume and total (open and closed) pore volume.

3.2.1.1 *Discussion*—Parameter D is based upon open pore volume (typically applicable at low impregnation pressures) and is calculated as follows:

$$D_o = \frac{W_2 - W_1}{\rho V_o} \quad (1)$$

where:

W_1 = the weight of the graphite sample before impregnation,

W_2 = the weight of the graphite sample after impregnation,

ρ = the density of molten salt, and

V_o = the open pore volume in the sample.

3.2.1.2 *Discussion*—Parameter D based upon total pore volume (typically at high impregnation pressures) is calculated as follows:

$$D_t = \frac{W_2 - W_1}{\rho V_t} \quad (2)$$

where:

V_t = the total pore volume in the sample.

4. Summary of Guide

4.1 This guide provides guidance on the impregnation of graphite with molten salt. The guide gives the various factors which need to be considered to perform the impregnation procedure. These include pretreatment of graphite samples, immersion of graphite in the molten salt, safe handling of the molten salt, and selection and control of the impregnation pressures and temperatures.

5. Significance and Use

5.1 The molten salt reactor is a nuclear reactor which uses graphite as reflector and structural material and fluoride molten salt as coolant. The graphite components will be submerged in the molten salt during the lifetime of the reactor. The porous structure of graphite may lead to molten salt permeation, which

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.