



Designation: D8091 – 21

## Standard Guide for Impregnation of Graphite with Molten Salt<sup>1</sup>

This standard is issued under the fixed designation D8091; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 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 represent material that has been exposed to a molten salt environment in a molten salt nuclear reactor. The user will need to ensure that impregnation temperature and pressure conditions reflect those pertaining to the molten salt environment, noting that the properties of the material will change once it becomes irradiated.

NOTE 1—The term impregnation is used throughout this guide as this is the correct term for the described process. Other terms such as infiltration and intrusion may be encountered by the user in other texts and the term intrusion is commonly used to describe penetration of open porosity in graphite in a molten salt 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.F0 on Manufactured Carbon and Graphite Products.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

B923 Test Method for Metal Powder Skeletal Density by Helium or Nitrogen Pycnometry  
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 differential pressure between the cover gas pressure and the pore pressure of the graphite specimen.

3.1.1.1 *Discussion*—If the impregnation starts at a pore pressure of atmospheric pressure, the impregnation pressure is the gauge pressure of the cover gas; if the impregnation starts at a pore pressure of “0” (vacuum), the impregnation pressure is the gauge pressure plus atmospheric pressure. For a pore pressure between 0 and atmospheric pressure, the impregnation pressure is (gauge pressure + atmospheric pressure – pore pressure).

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

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *Parameter  $D_o$* ,  $n$ —a measure of the extent of penetration of the graphite porosity by the molten salt expressed in terms of the open pore volume of the specimen.

3.2.1.1 *Discussion*—If there was no damage to the microstructure of the graphite during impregnation, then parameter  $D_o$  based upon open pore volume would be unity at saturation. This parameter is applicable when damage to the graphite microstructure during impregnation is absent or low. Mercury porosimetry studies indicate that the threshold pressure for microstructural damage is 13.8 MPa to 20.0 MPa (2000 psi to 3000 psi).<sup>3,4</sup> This threshold should be used as a guide by users when evaluating  $D_o$ . At high impregnation pressures, closed porosity may be broken into by the molten salt and parameter

<sup>3</sup> Dickinson, J. M., Shore, J. W., “Observations Concerning the Determination of Porosities in Graphites,” *Carbon*, Vol 6, 1968, pp. 937–941.

<sup>4</sup> Baker, D. J., Morris, J. B., “Structural Damage in Graphite Occurring during Pore Size Measurements by High Pressure Mercury,” *Carbon*, Vol 9, 1971, pp. 687–690.

\*A Summary of Changes section appears at the end of this standard