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Standard Practice for Vapor Attack on Refractories for Furnace Superstructures¹

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1. Scope

1.1 This practice describes a procedure for comparing the behavior of refractories in contact with vapors under conditions intended to simulate the environment within a glass melting or other type of furnace when refractories are exposed to vapors from raw batch, molten glass, fuel, fuel contaminants, or other sources. This procedure is intended to accelerate service conditions for the purpose of determining in a relatively short time the interval resistance to fluxing, bloating, shrinkage, expansion, mineral conversion, disintegration, or other physical changes that may occur.

1.2 *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. Significance and Use

2.1 This practice provides a guide for evaluating the resistance of refractories in glass melting furnace superstructures to vapor attack. This test method may also be useful for evaluating refractories in other applications where vapor attack occurs.

2.2 An electric-heated furnace is recommended. Water vapor and other atmospheric components in a gas- or fuel-fired furnace may participate in the chemical and physical reactions being studied. Results may differ, therefore, depending upon the nature and type of firing employed.

2.3 The degree of correlation between this practice and service performance is not fully determinable. This is intended to be an accelerated practice that generates a substantial degree of reaction in a relatively short amount of time. This acceleration may be accomplished by changing the composition and/or concentration of the reactants, increasing temperatures, or by performing the test in an isothermal environment.

2.4 Since the practice may not accurately simulate the service environment, observed results of this practice may not

be representative of those found in service. It is imperative that the user understand and consider how the results of this practice may differ from those encountered in service. This is particularly likely if the reaction products, their nature, or their degree differ from those normally found in the actual service environment.

2.5 It is incumbent upon the user to understand that this is an aggressive, accelerated practice and to be careful in interpreting the results. If, for example, the reaction species have never been found in a real world furnace, then this practice should not necessarily be considered valid to evaluate the refractory in question.

3. Apparatus

3.1 The crucible for containing the reactant shall be a dense alumina or platinum crucible of conical shape with dimensions of 43 mm in diameter at top, 33 mm in diameter at bottom, and 53 mm high.

3.2 The crucible-cover assembly (Fig. 1) may be supported within a suitable refractory holding crucible (Fig. 2) such as mullite to maintain the position of the cover, if an excessive amount of glass phase reaction product is anticipated.

3.3 The electric heating chamber shall be of sufficient size to accommodate at least three assemblies for comparative evaluation. The temperature control system shall be capable of maintaining a desired holding temperature with a tolerance of $\pm 3^\circ\text{C}$.

4. Specimen Preparation

4.1 The test specimen shall conform to the following dimensions with major faces cut or ground parallel and flat to form a tight seal with top of crucible:

- 4.1.1 Length, 55 ± 2 mm,
- 4.1.2 Width, 55 ± 2 mm, and
- 4.1.3 Thickness, 20 ± 1.0 mm.

4.2 *Selection*—Use specimens that are free of defects such as cracks, fissures, and voids. Where obvious defects in specimens appear after testing is completed, disregard the results and repeat the test.

4.3 Three specimens of a refractory brand shall constitute a test.

¹ This practice is under the jurisdiction of ASTM Committee C08 on Refractories and is the direct responsibility of Subcommittee C08.10 on Refractories for Glass. Current edition approved Oct. 10, 2000. Published December 2000. Originally published as C 987 – 83. Last previous edition C 987 – 00.