

Australian Standard®

Refractories and refractory materials—Physical test methods

Method 36: Determination of resistance to explosive spalling

PREFACE

This Standard was prepared by the Standards Australia Committee MN-007, Refractories and Refractory Materials, as an additional method in the AS 1774 series. This Standard has been prepared because of an identified need by the refractories industry for a method that can determine resistance to explosive spalling and differentiate between various monolithic refractory materials.

Users should note that the method is intended to be indicative, and might not be appropriate for use in contracts, as full precision data for the method has not been finalized. It was felt that the industry's need for a standard was more pressing than the need to specify a particular level of precision.

METHOD

1 SCOPE

This Standard sets out a method for determining the resistance to explosive spalling of monolithic refractories.

2 REFERENCED DOCUMENTS

AS

1774 Refractory and refractory materials—Physical test methods

1774.4.1 Method 4.1: Preparation of test pieces—By casting

2780 Refractories and refractory materials—Glossary of terms

AS/NZS

2243 Safety in laboratories (series)

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 2780 and that below apply.

3.1 Transition point temperature

Indicates the dewaterability of castable. A low transition point temperature indicates high dewaterability and this directly relates to high explosion resistance. Castable having high transition point temperature indicates poor dewaterability and low explosion resistance. (See Appendix A for further information.)

4 PRINCIPLE

A test specimen is prepared by casting and allowed to cure. The specimen is then enclosed in an explosion proof cage before being placed into a preheated kiln at a prescribed temperature.

5 SAFETY

For information on laboratory safety, reference should be made to the relevant parts of AS/NZS 2243.

6 APPARATUS

The following apparatus is required.

6.1 Mould

A split cylindrical mould with internal dimensions of 80 mm height and 80 mm diameter and having provision to allow for in-situ casting of a thermocouple into the centre of the cast specimen.

6.2 Thermocouple

A thin wire thermocouple (preferably Type K).

6.3 Temperature recorder

Any instrument capable of recording the temperature of the thermocouple, either continuously or at short intervals to an accuracy of 1°C.

6.4 Explosion proof cage

A cube with approximate dimensions of 150 mm per side, constructed of stainless steel mesh, having at least 60% openings, and one side able to be opened. The construction should be strong enough to withstand explosion of the test specimen at the test temperature.

6.5 Kiln

Electric or gas, capable of restoring the kiln temperature to the required test temperature to within 5°C, within 5 minutes after the test specimen is placed in the kiln.

6.6 Timing device

Any convenient timing device accurate to 1 s.

7 TEST SPECIMENS

The test specimen shall be prepared in accordance with AS 1774.4.1, using the mould as described in Clause 6.1 above. If information about transition point temperature is required, a wire thermocouple shall be cast in-situ into the centre of the test specimen. The test specimen dimensions shall be 80 mm diameter by 80 mm height, with each dimension accurate to 1 mm. Following casting and curing, the test specimen shall be prevented from drying prior to testing by placing in a sealed plastic bag, or by other means.

8 PROCEDURE

The procedure shall be as follows:

- (a) Prepare seven test specimens in accordance with Clause 7. The curing temperature is the subject of agreement between the interested parties. The specimens shall be tested as soon as practicable after a minimum of 24 h curing.
- (b) Heat the kiln (6.5) to 600°C. Maintain this temperature for at least 30 min.

- (c) Place an untested specimen inside the explosion proof cage (6.4), oriented as-cast, and secure the cage door opening.
- (d) Place the cage inside the kiln and start the timer (6.6) (and the specimen temperature recorder, if a specimen thermocouple is used).
- (e) Record the time(s) at which any explosions are heard.
- (f) Leave the cage inside the kiln for 20 minutes as a safety precaution. After 20 min have elapsed, remove the cage from the kiln.
- (g) Remove the test specimen from the cage and record the condition of the specimen according to the following classification:
 - (i) No damage—no damage to test specimen with the exception of minor cracking.
 - (ii) Minor damage—up to one third of the test specimen destroyed.
 - (iii) Major damage—more than one third of the test specimen destroyed.
- (h) If the test specimen has not been damaged at this temperature, then raise the kiln temperature by 100°C and soak for 30 min. If the test specimen has been damaged and is the first specimen tested at this particular test temperature, then test a second specimen at the same test temperature.

If the test specimen has been damaged and is the second specimen tested, then discontinue testing any further specimens.

If the test specimen is the second specimen tested at the particular test temperature and has not been damaged, then raise the kiln temperature by 100°C and soak for 30 minutes.

- (i) Repeat steps (c) to (h) until the specimen explodes or the maximum required test temperature up to a maximum of 1000°C has been reached.
- (j) Switch off the kiln.

9 PRECISION

Precision data for this test method is currently unavailable, however an interlaboratory test program gave the following results:

Kiln temperature °C	Lab A		Lab B		Lab C	
	1 st Cyl	2 nd Cyl	1 st Cyl	2 nd Cyl	1 st Cyl	2 nd Cyl
600	No damage				No damage	
700	No damage		No damage		Major damage	No damage
800	Major damage	No damage	Major damage	Major damage	Major damage	Major damage
900	Major damage	Major damage				
1000						

All castable specimens were cast and cured by Laboratory C.