Designation: C1656 – 07

StandardGuide for
Measuring the Reactivity of Hydraulic Refractory Castables using Exothermic Profile[1]

1. Scope

1.1 This guide applies to all castables with a reactive binder system that produces a measurable heat profile during the setting and hardening process. The majority of these systems will have calcium aluminate cement as one component of the binder system.

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 to determine the applicability of regulatory limitations prior to use .*

2. Referenced Documents

2.1 *ASTM Standards:*[2]
C401 Classification of Alumina and Alumina-Silicate Castable Refractories
C71 Terminology Relating to Refractories
C862 Practice for Preparing Refractory Concrete Specimens by Casting

3. Terminology

3.1 *Definitions:*

3.1.1 *EP – exothermic profile, n—* the curve generated by plotting temperature of the embedded thermocouple versus time.

3.1.2 *LCC, n—*Low cement castable

4. Significance and Use

4.1 The heat of hydration of a calcium aluminate based castable is liberated over a short period of time (as compared to Portland cement). This makes it easy to measure the heat profile using off-the-shelf thermocouple equipment.

4.2 The heat profile can be used to make inferences about the setting and strength gain behavior of a castable and sometimes the working time of a castable.

4.3 Factors that should be controlled when comparing two castables include: size, shape and mass of cast object, start temperature of the mix, temperature of environment, and the thermal conductivity of the environment. If these factors are held constant, then the two castables heat profiles can be compared.

4.4 The amount of heat rise created by the castable shall be a minimum of 5°F. If this is not achieved, then either a larger sample or better insulation (or both) should be used to increase the measurable heat release.

4.5 Varying the amount of cement in the castable, the amount of water, the type and quantity of admixtures, and so forth, will change the shape, maximum temperature and time to maximum temperature of the curve.

4.6 Following is an example of a curve generated for an LCC (see Fig. 1) that does exhibit two peaks, the first one marking the end of working time. In this curve one could also infer that the start temperature of the mix was 24°C and also that the hydraulic strength gain reaction was significantly started, but not completed by 6 h.

5. Apparatus

5.1 Mixing equipment as prescribed in C862.

5.2 Type T thermocouple (Type J, E, or K are also acceptable but not preferred due to range of sensitivity. Other types cannot be used.) Wire ends should be joined by solder or welding. Simple twisting is not recommended due to the potential for inaccurate readings.

5.3 Thermocouple sheathing (optional)

5.4 Voltmeter, data acquisition card or some other instrument to read the thermocouple mV value.

5.5 Container for storage of castable during heat profile generation and constant temperature environment in which to store the container.

5.6 Personal computer loaded with above card will make curve generation easier.