

Laboratory Burnability Trials

1 Scope

An approximation to kiln conditions can be made in a laboratory furnace by controlling the rate of heating and, if necessary, cooling. It is also possible to make samples of raw material in the laboratory.

It is, therefore possible to make laboratory clinker, from which useful information can be gleaned, by analysis and/or microscopy, to investigate raw materials and/or burning conditions.

This method is suitable, sometimes with variations, for all raw materials (or hot meals) for Portland cement production.

2 Principle

Samples of the raw materials are wetted with a suitable liquid (usually Industrial Methylated Spirit, to prevent migration of water-soluble material) and made into small balls. These are oven-dried and then heated under controlled conditions to produce laboratory clinker.

3 Reagents

3.1 Industrial Methylated Spirits (IMS)

4 Apparatus

4.1 Evaporating basins

4.2 Platinum boats

4.3 Platinum tipped tongs

4.4 Programmable Tube Furnace. A programmable tube furnace capable of heating at a controlled rate of 10 °C per minute and attaining a temperature of 1500°C. The furnace must be calibrated at all times when in use.

4.5 Stiff Wire, capable of withstanding temperatures of up to 1500°C for short periods, approximately 400mm long.

4.6 Heat resistant mats for placing hot items on.

5 Safety

Methylated Spirit is a harmful, highly flammable liquid. Skin contact should be avoided and lightweight gloves must be worn when handling materials that have been wetted with it.

It should only be used in a well-ventilated area, away from any sources of heat.

Some of the raw materials, especially hot meals, are harmful and skin contact should be avoided.

The furnace reaches very high temperatures and care should be used at all time but, particularly when taking samples out. Suitable heat resistant gloves must be worn when drawing the sample to the front of the furnace and the blue glass eye protection must be used when looking into the furnace when it is at a temperature above 1000°C.

The end plug must only be handled wearing suitable heat resistant gloves when hot and must be examined daily during periods of use for signs of loose material. If any loose material is found it must be removed or the plug replaced.

The wire and the tongs must be placed on the heat resistant mat to cool down after use.

6 Method

Oven-dry samples of the materials to be tested are wetted with a suitable liquid, in evaporating basins (4.1) (normally IMS (3.1) to avoid migration of water-soluble components), until the particles agglomerate substantially.

Small subsamples are worked by hand (by a technique found to be suitable for the materials involved and the amount of liquid present), to form balls, normally of about 8mm diameter.

The subsamples are then oven-dried in platinum boats (4.2) at 105°C.

After drying, the boats are placed in the centre of the pre-heated tube furnace(4.4), by means of platinum-tipped tongs(4.3) and stiff wire (4.5) held in a gloved hand and are treated according to the specific requirements of the test.(Typically the furnace would be pre-heated to 700°C and different samples would be heated at a rate of 10°C per minute to temperatures of 1350°C, 1400°C and 1450°C and left at that temperature for 20 minutes.) The samples are then removed by means of a stiff wire held in a gloved hand and platinum-tipped tongs and cooled in a desiccator.

The clinker produced can then be prepared for microscopy and/or chemical analysis.