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Dangerous goods - Test method for deflagration of self-reactive substances and organic peroxides in the package

危险货物 自反应物质和有机过氧化物包装件爆燃试验方法

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0 Warning

Warning - persons using this document should have practical experience of work in a formal laboratory. Particular attention is drawn to the fact that the test procedure involves the use of explosives, so that the relevant qualifications and site conditions are required, or the work is to be entrusted to a body that has them. This document does not purport to address all of the safety problems that may arise. It is the responsibility of the user to take appropriate safety and health measures and to ensure that the laboratory complies with the conditions laid down in the relevant national regulations.

1 Scope

This document describes the test principle, the materials and devices, the test and the evaluation of the result for the deflagration test on packages containing self-reactive substances and organic peroxides.

This document applies to the deflagration test on packages containing self-reactive substances and organic peroxides.

2 Normative references

The contents of the following documents constitute indispensable provisions of this document through normative reference in the text. For dated references, only the edition corresponding to that date applies to this document; for undated references, the latest edition (including all amendments) applies to this document.

GB/T 21535 Hazardous chemicals - Terminology for explosives; GB 30000.9-2013 Rules for classification and labelling of chemicals - Part 9: Self-reactive substances and mixtures; GB 30000.16-2013 Rules for classification and labelling of chemicals - Part 16: Organic peroxides; GB/T 30429 Industrial thermocouples.

3 Terms and definitions

The terms and definitions given in GB/T 21535, GB 30000.9-2013 and GB 30000.16-2013, together with the following, apply to this document.

3.1 organic peroxide. Liquid or solid organic substances containing the bivalent -O-O- structure, which may be regarded as derivatives of hydrogen peroxide in which one or both of the hydrogen atoms have been replaced by organic radicals, including organic peroxide formulations (mixtures). Organic peroxides are thermally unstable substances or mixtures that may undergo exothermic self-accelerating decomposition. [SOURCE: GB 30000.16-2013, 3.1, modified]

3.2 self-reactive substance. Thermally unstable liquid or solid substances or mixtures liable to undergo a strongly exothermic decomposition even in the absence of oxygen (air). [SOURCE: GB 30000.9-2013, 3.1, modified]

4 Test principle

The test sample is completely covered with a confinement material such as fine sand and is ignited by remote firing, so that it can be observed whether the sample undergoes a deflagration reaction. The state of breakage of the packaging after the test is used to judge whether the substance is able to propagate a deflagration rapidly.

5.1 Igniter charge

It consists of a powder charge, an ignition head and a plastic film. The powder charge is 2 g of black powder. The black powder is spread evenly at the centre of the plastic film, the ignition head is then buried within the black powder, and finally wire, plastic cord or similar line material is used to bind and fix the assembly.

5.2 Exploder

A device used to initiate the igniter charge, which produces a high-current electrical pulse that fires the ignition head inside the igniter charge. The maximum pulse voltage shall be not lower than 2000 V.

5.3 Ignition line

A twisted pair used to connect the igniter charge to the exploder so that the operator can fire from a distance. It is protected on the outside by insulating flame-retardant material, and the cross-sectional area of the inner conductor shall be not less than 2 square millimetres.

5.4 Confinement material

A material able to cover the sample and build a confined environment around it. Dry loose sand, with no hard lumps or foreign matter inside it, should be used.

5.5 Support

Used to hold the igniter charge in position at the centre of the sample.

5.6 Temperature measuring system

It measures the temperature close to the sample during the test; its main parts are a thermocouple, thermocouple wire and a temperature data acquisition unit. The relevant technical parameters of the temperature measuring system should include the following.

a) Thermocouple: the range covers room temperature to 1200 °C, the temperature measuring accuracy is not lower than 0.1 °C, the response time is shorter than 1 s, the outer coating is even and firmly adherent, and it complies with GB/T 30429.

b) Temperature data acquisition unit: the sampling frequency is not lower than 1 Hz, and it is able to work continuously and stably throughout the test.

6.1 Test preparation

6.1.1 The outer appearance of the sample package is inspected; the package shall be intact and no incompatible foreign matter shall remain on the outside of the package.

6.1.2 No foreign matter that might cause a deviation in the test result, such as reducing substances, shall remain on the thermocouple sensor of the temperature measuring unit.

6.2 Test steps

6.2.1 Fixing the igniter charge. The sample is placed on level, dry and hard ground. The

igniter charge should be placed at the centre of the interior of the sample. Where it cannot be placed at the centre directly, for example where the sample is a hard monolithic solid, the igniter charge is placed on the upper surface of the sample. For liquid samples the support specified in 5.5 may additionally be used to help hold the igniter charge in place.

6.2.2 Installing the temperature measuring unit. A thermocouple is installed beside the igniter charge and may be secured where necessary with a retort stand, wire or the like. The temperature data acquisition unit is installed in a safe position and connected to the thermocouple.

6.2.3 Confining the sample. The confinement material is used to cover the sides and the top of the sample, the thickness in each direction being not less than 0.5 m, as shown in Figure 1.

The key to Figure 1 identifies 1, the hard ground; 2, the retort stand; 3, the thermocouple; 4, the sample; 5, the igniter charge; 6, the dry sand; and 7, the ignition line.

6.2.4 Preparing for the test. The ignition line is used to connect the igniter charge to the exploder and personnel withdraw to a safe position.

6.2.5 Ignition. The power supply of the exploder is switched on and the ignition device is started.

6.2.6 Recording. The state of the sample is monitored by observing the temperature data acquisition unit. Test personnel may enter the test site only once the temperature has fallen back to room temperature. If the temperature measuring system fails as a result of the test, all test personnel shall wait at least 30 min before entering the test site. The condition of the sample after the test is recorded, including residues of the self-reactive substance, the organic peroxide and any explosive articles, fragments, and the state after the reaction, as the basis for judging the level of reaction of the sample.

6.2.7 Criterion for terminating the test. If it is observed that the inner container or the outer container has broken into three or more pieces (excluding the bottom and the top of the container), the test result is described as a plus sign and the testing is stopped. If the fragments of the inner container or the outer container number fewer than three (excluding the bottom and the top of the container), the steps above are repeated and testing continues until a plus result is obtained or until three consecutive tests all give a minus result; examples of such judgements are given for information in Annex A.

7 Evaluation of the result

Where any inner container or outer container breaks into three or more pieces (excluding the bottom and the top of the container), the test result is described as a plus sign, that is, the substance under test deflagrates in that package.

Where in three tests the fragments of the inner container and of the outer container all