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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 5169.38-2014

Fire hazard testing for electric and electronic products - Part 38: Toxicity of fire effluent - Summary and relevance of test methods

电工电子产品着火危险试验 第38部分:燃烧流的毒性 试验方法概要和相关性

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0 Introduction

The parts of GB/T 5169 that deal with the toxicity of fire effluent give the electrotechnical product standards committee guidance in taking over and carrying out the methods recommended by ISO/TC 92, the aim being to keep to a minimum the poisoning hazard that arises from fires involving electrical and electronic products.

Where an electrical or electronic product is chiefly the victim of a fire, what the fire effluent releases may add to the fire hazard, and that may in turn weigh as an important factor in the fire hazard taken as a whole.

In assessing the poisoning hazard of a product fire in its product standards, the electrotechnical product standards committee is to note that the toxic potency tests and the other toxicity tests described in this part cannot be used directly in a product specification. The data obtained from a toxic potency test serve only as part of the data for a poisoning hazard assessment, and other basic data on how the product answers to fire, such as the mass loss rate, have to be weighed as well.

1 Scope

This part of GB/T 5169 outlines in brief the test methods in common use for assessing acute toxic potency, along with other toxicity test methods. It takes in particular observations on how far those methods correspond to a real fire, and offers recommendations on how the test methods are to be used.

This part also offers recommendations on which test methods can yield toxic potency data that bear on a real fire, and on which methods suit fire hazard assessment and fire safety engineering work.

2 Normative references

The clause carries the usual formula on dated and undated references, followed by the list of documents.

The documents listed are GB/T 5169.18-2013, part 18 of the series on the toxicity of fire effluent, general guidance, an identical adoption of IEC 60695-7-1:2010; IEC 60695-7-3 on the use and interpretation of test results; ISO 13344 on the estimation of the lethal toxic potency of fire effluents; ISO 13571:2007 on life-threatening components of fire and the guidelines for estimating the time available for escape from fire data; ISO 16312-1:2010 and ISO/TR 16312-2:2007 on the guidance for assessing the validity of physical fire models used to obtain fire effluent toxicity data for fire hazard and risk assessment, the first part carrying the criteria and the second the evaluation of individual physical fire models; ISO 19701 on methods for sampling and analysis of fire effluents; ISO 19702 on the guidance for the analysis of gases and vapours in fire effluents using Fourier transform infrared gas

analysis; ISO 19703:2010 on the generation and analysis of toxic gases in fire and the calculation of species yields, equivalence ratios and combustion efficiency in experimental fires; and ISO 19706:2007 on the guidelines for assessing the fire threat to people.

3 Terms and definitions

The terms and definitions given in ISO/IEC 13943:2008 apply to this document; for convenience some of them are repeated in the clause, each with the reference to the definition number it is drawn from.

3.1 Acute toxicity is toxicity that produces its toxic effect quickly; the entry cross-refers to toxic potency at 3.45. 3.2 and 3.3 give the intransitive and the transitive senses of burn, undergoing combustion and causing combustion respectively. 3.4 combustible as an adjective is defined as capable of being ignited and of burning, and 3.5 combustible as a noun as an article capable of burning.

3.6 Combustion is the exothermic reaction of a substance with an oxidizing agent; a note adds that combustion usually gives off fire effluent together with flame, glowing or both. 3.7 Combustion efficiency is the ratio of the heat released in incomplete combustion to the heat that would in theory be released in complete combustion; the notes state that the term is used only where complete combustion is possible and that the quantity is dimensionless and usually given as a percentage. 3.8 Complete combustion is combustion in which the combustion products are all fully oxidized; the notes explain that where the oxidant is oxygen this means that all the carbon turns into carbon dioxide and all the hydrogen into water, and that where the burning material holds elements other than carbon, hydrogen and oxygen, those other elements are to be converted into the most stable products under standard conditions at 298 K.

3.9 Concentration is mass per unit volume. The notes give the representative unit for fire effluent as grams per cubic metre; state that for a toxic gas the concentration is usually expressed as a volume fraction at 298 K and one atmosphere, the representative unit being microlitres per litre, which is equivalent to cubic centimetres per cubic metre; and explain that at a given temperature and pressure the gas concentration may be worked out from the volume fraction, on the assumption that the atmosphere behaves ideally, by multiplying the volume fraction by the density of the gas at that temperature and pressure.

3.10 An enclosure is, in the built environment, the outer boundary of a space, which may hold one or more openings. 3.11 Equivalence ratio is printed as the fuel to air ratio needed for the theoretical mixture divided by the actual fuel to air ratio; the notes state that under standard conditions dry air holds 20.95 % oxygen by volume, that in practice the oxygen concentration of the input gas may vary and the calculation is therefore to be referred to dry air, and that the quantity is dimensionless.

3.12 Exposure dose is the measured maximum quantity of inhalable toxic gas or fire

effluent, obtained by integrating the area under the concentration against time curve; the notes give the representative unit for fire effluent as gram minutes per cubic metre and, for a toxic gas at 298 K and one atmosphere, microlitre minutes per litre, with a cross-reference to volume fraction at 3.49. 3.13 Exposure time is the length of time for which a person, an animal or a specimen is exposed under specified conditions. 3.14 The F factor is the lowest concentration of an irritant toxic gas that would seriously impede escape from a fire; the note gives the same volume fraction convention and unit as above.

3.15 Fire is, in its usual sense, a combustion process marked by the emission of heat and fire effluent, often accompanied by smoke, flame, glowing or a combination of them. 3.16 Fire effluent is all the gases and aerosols, suspended particles included, produced by combustion or pyrolysis in a fire. 3.17 A fire hazard is a potential substance or condition, undesirable and brought about by fire. 3.18 Fire hazard assessment is the assessment of the causes that may bring on a fire, of the potential and the type of the fire development that follows, and of the consequences the fire may have.

3.19 A fire plume, or plume, is the buoyant gas flow above a fire together with any material flowing within it. 3.20 Fire safety engineering is an application that improves or assesses design in the built environment by engineering methods founded on scientific principles, through analysing a particular fire situation or quantifying a set of fire risks. 3.21 A fire scenario is a qualitative description of the course a fire takes in time, arrived at by identifying the characteristics of the fire under study and the key events that set it apart from other fires that might occur; a note adds that it typically defines the ignition and growth of the fire, the fully developed stage, the decay stage, and the environment and the systems that bear on the course of the fire. 3.22 A fire test is a test that determines fire performance or exposes an object to the effects of a fire; a note adds that its results may be used to quantify the severity of ignition of a specimen or to determine its fire resistance or its reaction to fire.

3.23 Flame retardance is the characteristic of a material that shows retardation, termination or prevention of flaming combustion; the notes add that it may be an inherent property of the base material or may be obtained by special treatment, and that the degree a material shows during a test changes with the test conditions. 3.24 A flame retardant, as a noun, is a substance added or a treatment applied so as to suppress or delay the appearance of flame, to lower the rate of flame spread, or both; a note adds that using one does not necessarily suppress ignition or terminate combustion. 3.25 Flame retarded means treated with a flame retardant. 3.26 Flashover is, at the fire stage so named, the sudden transition of the whole surface of the combustible material within a given range into a state of fire.

3.27 Fractional effective concentration, FEC, is the ratio of the concentration of an irritant to the concentration of that irritant expected to produce a specified effect on a normally sensitive exposed subject; the notes state that the concept reaches all effects, incapacitation, lethality and other end effects included, that where it is not used for one