BRITISH STANDARD

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Explosives for civil uses — Propellants and rocket propellants —

Part 6: Solid rocket propellants — Guide for the determination of integrity of inhibitor coatings

The European Standard EN 13938-6:2004 has the status of a British Standard

ICS 71.100.30

BSI British Standards

National foreword

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The UK participation in its preparation was entrusted to Technical Committee CII/61, Explosives for civil uses, which has the responsibility to:

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Explosivstoffe für zivile Zwecke - Treibladungspulver und Raketentreibstoffe - Teil 6: Feste Raketentreibstoffe - Leitfaden zur Bestimmung der Integrität von Inhibitorbeschichtungen

This European Standard was approved by CEN on 6 February 2004.

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Foreword

This document (EN 13938-6:2004) has been prepared by CEN /TC 321, "Explosives for civil uses", the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2004, and conflicting national standards shall be withdrawn at the latest by November 2004.

This European Standard is one of a series of standards with the generic title *Explosives for civil uses – Propellants and rocket propellants.* The other parts of this series are listed below:

prEN 13938-1 Part 1: Requirements.

prEN 13938-2 Part 2: Determination of resistance to electrostatic energy.

EN 13938-3 Part 3: Determination of deflagration to detonation transition.

EN 13938-4 Part 4: Determination of burning rate under ambient conditions.

prEN 13938-5 Part 5: Solid rocket propellants. Determination of voids and fissures.

prEN 13938-7 Part 7: Determination of properties of black powder.

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Introduction

Incomplete adhesion of, or flaws in, the inhibitor coating to solid rocket propellant grains and the casing can result in dangerously high pressures in rocket motors and adversely affect their safety and performance. The category "Solid rocket propellants" encompasses charges over a wide range of composition and dimensions. It is not possible to define an acceptable level of defects (lack, crack or blister) in the inhibitor coating which is applicable to the whole range of products. It is necessary for this to be agreed between the producer and the customer. Consequently a Harmonised Standard cannot be defined with criteria for acceptance levels of integrity of inhibitor coating. However it is important that interested parties are aware of the methods which can be used to assess the extent of integrity of inhibitor coating in any particular product. This standard describes a number of methods which have been used. A method can be selected which is most appropriate to the charge under examination.

1 Scope

This European Standard provides a guide to non-destructive testing (NDT) methods for detecting the integrity of inhibitor coatings in solid rocket propellants.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13857-1:2003, *Explosives for civil uses - Part 1: Terminology*

EN ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:1999)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13857-1:2003 and the following apply.

3.1
NDT method
discipline applying a physical principle in non-destructive testing

NOTE: An example of an NDT method is ultrasonic testing.

3.2
NDT technique
specific way of utilising an NDT method

NOTE: An example of an NDT technique is immersion ultrasonic testing.

3.3
NDT procedure
orderly sequence of rules, which describes step by step how and in which sequence an NDT technique should be applied to a specific field

3.4
lack of coating
absence of inhibitor coating in a limited area on the surface of the propellant, which normally should be coated, or evident reduction of coating thickness on such a surface

3.5
crack in coating
discontinuity in coating which does not expose the propellant

3.6
blister in coating
Inclusion of gas under the external surface of inhibitor coating that can cause a hump

3.7
integrity of inhibitor coating
presence or absence of specified defects in the inhibitor coating

3.8
solid rocket propellant
propellant consisting of one or more blocks, usually with a central hole, with an external inhibitor in order to burn in a controlled manner

3.9
debonding
lack of adhesion causing separation of coating and propellant

4 NDT methods

The integrity of an inhibitor coating of a solid rocket propellant can be assessed by various NDT methods normally used for the testing of metal and welds. The NDT method and technique selected depend on many factors. Among them it may be useful to distinguish:

- minimum area of uncoated propellant or minimum size of crack or blister in the coating to be detected;
- type of propellant to be inspected;
- type of inspection (continuous production line inspection or the individual inspection of samples);
- number of units to be inspected.

The main NDT methods used are shown in Table 1.

5 Test report

The test report shall conform to EN ISO/IEC 17025. In addition, the following information shall be given:

a) reference to this standard;

b) identification of the product tested;

c) reference to the agreed acceptance criteria for the product tested;

d) reference to the NDT procedure used;

e) identification of the NDT record(s);

f) results of the NDT tests.

Table 1 – NDT methods

NDT method	Detection of	Comments
Film radiography (X-ray or isotopes)	- blister - debonding - inclusion of some types of foreign bodies	- Suitable for all types of propellant unit - Detection of possible defects involves a lot of pictures to cover all appropriate angles of incidence - Personnel protection required
X-ray radioscopy	- blister - debonding - inclusion of some types of foreign bodies	- Suitable for all types of propellants units - No films involved - Personnel protection required
X-ray tomography	- blister - debonding - inclusion of some types of foreign bodies	- Suitable for all types of propellant units - More expensive than X- ray radioscopy - Personnel protection required
Ultrasonic	- blister - debonding	- A liquid or gel is required for sound transmission - May be adapted for in-line inspection - No personnel protection required
Infra-red thermography	- debonding	- Suitable only for propellant units without metallic case - Easy to use - No personnel protection required
Visual testing	- lack of coating - crack in coating - inclusion of some types of foreign bodies	- With or without optical instruments, such as a magnifying glass

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