ISO 22088 -1 Plastics — Determination of Resistance to Environmental Stress Cracking (ESC) – Testing Equipment

Description

1 Scope

1.1 This part of ISO 22088 provides information and general guidance relevant to the selection of the test
method to be used to determine environmental stress cracking (ESC).

1.2 Part 2 describes a method in which a test specimen is subjected to a constant tensile load, while immersed in a stress cracking agent at a specified temperature. The time and/or stress at which the specimen breaks is recorded.

1.3 Part 3 describes a method in which strips of plastic are subjected to a fixed flexural strain and exposed
to a stress cracking agent for a predetermined period.

1.4 Part 4 describes a method in which a hole of specified diameter is drilled in a specimen and an oversized steel ball or pin is inserted into the hole while the test specimen is brought into contact with a stress cracking agent.

1.5 Part 5 describes a method in which a constant tensile deformation is applied to a specimen which is immersed in a stress cracking agent at a temperature selected for testing.

1.6 Part 6 describes a method in which a slowly increasing strain is applied to a specimen immersed in a
stress cracking agent.

1.7 These methods are applicable to thermoplastic materials only.

1.8 These are essentially ranking tests and are not intended to provide data to be used for design or performance prediction.

4 Principles of the test

4.1 In Part 2, a test specimen is subjected to a constant tensile load while immersed in a stress cracking
agent at a specified temperature. Three methods may be used. Method A determines the stress required to produce rupture at 100 h. Method B determines the time to rupture at a specified constant tensile stress. In method C, the time to rupture for a series of applied stresses is plotted to determine if the time to rupture meets a specified agreed-upon stress.

4.2 In Part 3, strips of plastic are subjected to a fixed flexural strain and exposed to a stress cracking agent
for a predetermined period. Using a series of forms with decreasing radii, increasingly higher strains are produced in the outer surface. After a specified exposure to the stress cracking agent, specimens are removed, inspected and tested for the indicative property, such as tensile strength.

4.3 In Part 4, a hole of specified diameter is drilled in the specimen and an oversized steel ball or pin is inserted into the hole while the test specimen is brought into contact with a stress cracking agent. After a

specified period of exposure, specimens are inspected and/or tested for the indicative property. In some cases, a parallel test conducted in air is carried out for comparison purposes.
4.4 In Part 5, a constant tensile deformation is applied to a specimen immersed in a stress cracking agent
at a temperature selected for testing. The ESC of the test material is determined by comparing the amount of deviation of a defined critical stress determined in the stress cracking medium from that determined in air.
4.5 In Part 6, a slowly increasing strain is applied to a specimen immersed in a stress cracking agent. Testing is conducted at relatively low strain rates to enhance the effect of the stress cracking medium on the specimen. Development of crazes causes the strain to be taken up by the crazes so that the stress is reduced compared to tests conducted in an inert environment.

5 Applicability of the test method
5.1 Environmental stress cracking tests are used as quality control tools and in research and development
to evaluate stress crack resistance.
5.2 When selecting a test method, it is important to consider the types of stress and strain a material will
experience in service. Care must be taken when using constant strain test methods, such as the bent strip
method or the pin impression method, as the stress applied to the material will decay with time due to stress relaxation.
Annex A lists typical plastics that are characterized by each type of environmental stress cracking test.
5.3 Comparisons of materials must be based on identical test conditions for each material. Selection of the test conditions will depend on the material and the application.

6 Test specimen preparation
Environmental stress cracking of a specimen is influenced not only by the material, but also by the method of preparation. Materials can only be compared using specimens prepared in a similar manner and in the same state.
Specimens shall be prepared in accordance with the appropriate International Standard. If no procedure for specimen preparation is given, specimens shall be machined from sheet or from products by the methods specified in ISO 2818.
To obtain comparable results, the test specimens used shall have the same dimensions, state and age and
shall have been prepared by the same method of preparation. When cut or machined (ISO 2818) from sheet or articles, they shall be cut from corresponding places and in corresponding directions. The machined surfaces and edges of the finished specimens shall be free of visible flaws, scratches and other imperfections.
Care shall be taken to handle only the ends of the test specimens. If the test specimens are not clean, they
shall be cleaned, before mounting, with a liquid that has no effect on them. Since cleaning can influence the test results, the cleaning procedure, if used, shall be included in the test report.
Moulded test specimens often have a considerable amount of orientation. If the load is applied parallel to the direction of injection, the time to rupture may be significantly lower than in the transverse direction. If the specimens are anisotropic, it may be useful to carry out tests with the load applied in

different directions relative to the direction of injection. If specimens are prepared by moulding, the procedures shall be in accordance with ISO 293 or ISO 294-1.

7 Conditioning and test conditions

7.1 Conditioning

Unless otherwise agreed between the interested parties, the test specimens shall be conditioned before testing for at least 24 h at (23 ± 2) °C and (50 ± 10) % relative humidity.

7.2 Test temperature

The test temperature shall normally be (23 ± 2) °C. If required, other temperatures may be used, preferably selected from the following:

(40 ± 2) °C, (55 ± 2) °C, (70 ± 2) °C, (85 ± 2) °C, (100 ± 2) °C,

or as agreed upon by the interested parties.

7.3 Test medium

The test medium used for the test shall be that specified in the relevant International Standard for the materialtested. If nothing is specified, use either the agent which will be in contact with the material in the expected application or a reference product agreed upon between the interested parties.

During long exposures and especially at elevated temperatures, the nature and composition of the test environment may change and this shall be taken into consideration. It may be necessary to agree on renewal after specified periods.

NOTE Examples of reference products are:

a) 95 % (by volume) ethanol — pharmaceutical quality;

b) a 1 % (by mass) solution of nonylphenoxy-poly(ethylene-oxy)ethanol 1) in distilled water;

c) refined linseed oil (see ISO 150).

Category

1. Equipment for Standards
2. Standards