SLOVENSKI STANDARD
oSIST prEN ISO 20728:2017

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Korozija kovin in zlitin - Ugotavljanje odpornosti magnezijevih zlitin proti pokanju zaradi napetostne korozije (ISO/DIS 20728:2017)

Corrosion of metal and alloys - Determination of resistance of magnesium alloys to stress corrosion cracking (ISO/DIS 20728:2017)

Korrosion von Metall und Legierungen - Bestimmung der Beständigkeit von Magnesiumlegierungen gegen Spannungsrisskorrosion (ISO/DIS 20728:2017)

Corrosion des métaux et alliages - (ISO/DIS 20728:2017)

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Corrosion of metal and alloys — Determination of resistance of magnesium alloys to stress corrosion cracking

Corrosion des métaux et alliages —

ICS: 77.060

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 20728 was prepared by Technical Committee ISO/TC 156, *Corrosion of metals and alloys*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

Corrosion of metal and alloys — Determination of resistance of magnesium alloys to stress corrosion cracking

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1 Scope

This standard specifies a method for the determination of resistance to stress corrosion cracking (SCC) of magnesium alloys intended for use in structural applications (such as magnesium front end, gearbox and clutch housing units, steering column parts, shift actuators, valve covers and housings, brackets and intake manifold blades, electronic devices, power tools and medical equipment). The method allows determination of the resistance to SCC as a function of the chemical composition, the method of manufacture and heat treatment of magnesium alloys.

The standard is applicable to cast and wrought magnesium alloys in the form of castings, semi-finished products, parts and weldments and covers the method of sampling, the types of specimens, the loading procedure, the type of environment and the interpretation of results.

The standard allows assessment of the relative performance of materials and products in environments containing chlorides or sulphates, provided that the failure mechanism is not changed, but does not qualify a material or product for service application.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7539-1, *Corrosion of metals and alloys — Stress corrosion testing — Part 1: General guidance on testing procedures*

ISO 7539-2, *Corrosion of metals and alloys — Stress corrosion testing — Part 2: Preparation and use of bent-beam specimens*

ISO 7539-3, *Corrosion of metals and alloys — Stress corrosion testing — Part 3: Preparation and use of U-bend specimens*

ISO 7539-4, *Corrosion of metals and alloys — Stress corrosion testing — Part 4: Preparation and use of uniaxially loaded tension specimens*

ISO 7539-5, *Corrosion of metals and alloys — Stress corrosion testing — Part 5: Preparation and use of C-ring specimens*

ISO 7539-6, *Corrosion of metals and alloys — Stress corrosion testing — Part 6: Preparation and use of precracked specimens for tests under constant load or constant displacement*

ISO 7539-7:2005, *Corrosion of metals and alloys — Stress corrosion testing — Part 7: Method for slow strain rate testing*

ASTM D 1384-96, *Standard Test Method for Corrosion Test for Engine Coolants in Glassware*

3 Terms and definitions

For the purposes of this document the terms and definitions given in ISO 8044 and in ISO 7539-1 apply.

4 General principles

4.1 Stress corrosion cracking of magnesium alloys is sensitive to microstructural orientation with respect to the stress axis. Accordingly, in testing SCC resistance, it is necessary to consider the manner in which the specimens are prepared from cast or wrought alloy so that orientation dependent SCC resistance may be assessed.

4.2 The corrosion of magnesium is associated with hydrogen evolution and generation of often very soluble corrosion products. For that reason, testing in stagnant conditions is preferred during continuous immersion as stirring may cause secondary effects, e.g. removal of corrosion product.

4.3 Two methods of immersion in the solution are proposed:

— alternate immersion,

— continuous immersion.

4.4 Tests may be conducted under constant load, constant strain or by the slow strain rate technique with evaluation criteria for stress corrosion cracking resistance appropriate to the chosen loading method.

4.5 The method of loading, the value of stresses, corrosive environment and criteria of evaluation should be agreed between the interested parties according to the purpose of the testing.

5 Apparatus and materials

5.1 Loading apparatus

Tensile stresses in the specimens are produced with yokes, stressing screws, springs, lever devices and special testing machines.

5.2 Construction materials for the test set-up

5.2.1 If in contact with the corrosive environment, the construction materials for the test set-up shall not be affected by the corrodent to such an extent that they can cause contamination of the solution and change its corrosiveness.

5.2.2 Use of inert plastics or glass is recommended for the corrosion cell where feasible.

5.2.3 Metallic components in contact with the solution shall be made from an appropriate corrosion resistant material, or protected with a suitable corrosion-resistant coating, sufficient to avoid galvanic coupling.

5.3 Specimen holders

5.3.1 The specimen holders shall be designed to electrically insulate the specimens from each other and from any bare metal parts. When this is not possible, as in the case of certain stressing bolts or jigs, the bare metal contacting the specimen shall be isolated from the corrodent by a suitable coating.

Protective coatings shall be of a type that will not leach inhibiting or accelerating ions or protective oils or leave any residue, e.g. vapour, on the non-coated portions of the specimen holder. In particular, coatings containing chromates or releasing any other contaminants should be avoided. All samples holders should be degreased after coating.

5.3.2 The equipment required for slow strain rate testing is a device that permits a selection of strain rates whilst being powerful enough to cope with the loads generated. Strain rates that have been used most frequently in testing initially plain specimens are in the range 10^{-7} s^{-1} to 10^{-5} s^{-1}.

5.4 Apparatus for alternate immersion in solutions

5.4.1 Any suitable mechanism may be used to accomplish the immersion portion of the cycle provided that:

a) it achieves the specified rate of immersion and removal; and

b) the apparatus is constructed of suitable inert materials.

The usual methods of alternate immersion are

a) specimens are placed on a movable rack that is periodically lowered into a stationary tank containing the solution;

b) specimens are placed on a corrosion wheel arrangement which rotates every 10 min through 60° and thereby passes the specimens through a stationary tank of solution;

c) specimens are placed in a stationary tray open to the atmosphere and the solution is moved by air pressure, by a non-metallic pump, or by gravity drain from the reservoir to the tray.

5.4.2 The rate of immersion and removal of the specimens from the solution shall be as rapid as possible without jarring them. For purposes of standardization, an arbitrary limit shall be adopted such that no more than 2 min elapses in the transfer from solution to air or vice versa.

6 Sampling

6.1 In general, this standard specifies three specimen orientations for thick products and two for thin products. The orientation diagram is given in Figure 1. In Figure 1 a), the first direction refers to the stress axis and the second direction refers to the direction of crack growth.