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Responsible committee: ACE/61/-/24 Light Alloys for Aerospace Purposes

Interested committees:

Title: Draft BS EN 4881 "Aerospace series - Micro-arc oxidation of aluminum and aluminum alloys"

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Introduction

This draft standard is based on European discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent British Standard. Comment is particularly welcome on national, legislative or similar deviations that may be necessary.

Even if this draft standard is not approved by the UK, if it receives the necessary support in Europe, the UK will be obliged to publish the official English Language text unchanged as a British Standard and to withdraw any conflicting standard.

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Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

Aerospace series – Micro-arc oxidation of aluminum and aluminum alloys

Luft- und Raumfahrt — Xxx

Série aérospatiale — Oxydation micro-arc de l'aluminium et des alliages d'aluminium

Scope

Normative references

Terms and definitions

- General terms

- Technical terms

General principles of the process

- Purpose of the process

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- Process schedule

- Process conditions

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 - Masking

 - Surface pre-treatment

 - Micro-arc oxidation

 - Generator characteristics

 - Electrolyte

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 - Rinsing bath

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Samples Test specimens requirements

- General

- Materials

- Tests for the qualification

- Periodic tests

Parts requirements

- Conditions of parts prior to processing

- Inspections before the processing

- Inspections after the micro-arc oxidation

Quality assurance

- Process approval

- General

Annex A (normative) Tests on samples test specimens for the qualification

Annex B (normative) Periodic tests on samples test specimens

Annex C (normative) Tests on parts

Annex D (normative) Wear resistance test

Bibliography

1 Scope

This European Standard defines the requirements for micro-arc oxidation of aluminum and aluminum alloys for corrosion protection, wear, erosion, dielectric, thermal properties.

The purpose of this European Standard is to give design, quality and manufacturing requirements. It does not give complete in-house process instructions; these are given in the processors detailed process instructions.

This European Standard relates only to micro-arc oxidation. It does not relate to finishing techniques, such as mechanical post treatment.

2 Normative references

EN 6072, Aerospace series — Metallic materials — Test methods — Constant amplitude fatigue testing

EN ISO 1463, Metallic and oxide coatings — Measurement of coating thickness — Microscopical method

EN ISO 2360, Non-conductive coatings on non-magnetic electrically conductive basis materials — Measurement of coating thickness — Amplitude-sensitive eddy-current method

EN ISO 2376, Anodizing of aluminium and its alloys — Determination of electric breakdown potential

EN ISO 2409, Paints and varnishes — Cross-cut test

EN ISO 4516, Metallic and other inorganic coatings — Vickers and Knoop microhardness tests

EN ISO 9220, Metallic coatings — Measurement of coating thickness — Scanning electron microscope method

EN ISO 9227, Corrosion tests in artificial atmospheres — Salt spray tests

ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

3 Terms and definitions

3.1 General terms

3.1.1

OEM

producer who manufactures products or components that are purchased by a company and retailed under that purchasing company's brand name

Note 1 to entry: the OEM can also apply the process.

3.1.2

manufacturer

company or person who makes, manufactures, assembles components

Note1 to entry: the manufacturer can also apply the process.

3.1.3

processor

company or person who applies the process

3.1.4

process instruction

document that describes the application scopes, detailed process (key parameters, detailed steps, etc.), quality management, environmental and safety regulations, etc.

3.1.5

batch

unless otherwise specified, it comprises parts of the same type (i.e. shape, size, material), processed at the same time in the same bath

3.2 Technical terms

3.2.1

Mechanically Disturbed Layer (MDL)

layer that is present at the surface resulting from the heat treatment and rolling process of the material

3.2.2

pit

surface corrosion defect at which the oxide layer is penetrated and/or perforated

Note 1 to entry: Typical characteristics of corrosion pits are:

- rounded or irregular or elongated geometry,
- comet tail or line or halo that emerges from the cavity,

some corrosion by-products inside pits (on aluminum, the by-product may be granular, powdery or amorphous and white, grey or black in colour).

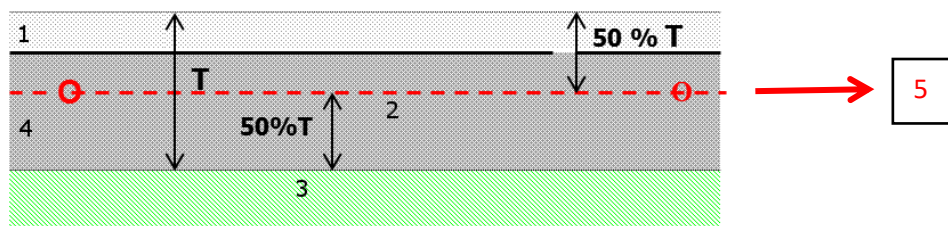
To be considered as a corrosion pit, a surface cavity must exhibit at least two of the above characteristics.

3.2.3

MAO Layer

layer which is constituted of a friable/porous layer and a functional layer

Note 1 to entry : See Figure 1.



Key

- 1 Friable/porous layer
- 2 Hard ceramic (mainly α -Al₂O₃)
- 3 Aluminum
- 4 Functional layer
- 5 Initial surface

Figure 1 – MAO layer

3.2.4

friable/porous layer

porous and superficial part of the coating that has to be removed for wear or erosion application (type C)

3.2.5

functional layer

functional and hard part of the coating useful for wear application and paint adhesion (porous)

4 General principles of the process

4.1 Purpose of the process

Plasma Electrolytic Oxidation (PEO) or Micro Arc Oxidation (MAO) is an electrochemical process of anodization that is performed thanks to micro-discharges created on the surface of components immersed in an electrolyte. The process is applied to Aluminum, Titanium, and Magnesium to grow a dense ceramic oxide layer that improves mechanical, wear, thermal, dielectric, and corrosion properties.

A controlled high alternating current is applied to a metal part immersed in an electrolytic bath. Due to this current and significant voltage resulting, micro-discharges as well as the development of an intense plasma are created on the surface of the metal. This plasma oxidizes the surface of the part and a ceramic oxide layer grows from the substrate material. The oxide layer is produced by subsurface oxidation. As a result, the process can produce very thick coatings of varying porosity.

This specification applies to aluminum and aluminum alloys.

4.2 Applicability

4.2.1 Type A: As processed

This type of coating can be painted.

4.2.2 Type B: After blasting operation

It is intended for wear applications.

This type of coating can be painted.

4.2.3 Type C: After machining operation

It is intended for either wear or erosion applications when tightened geometrical tolerances may be achieved.

4.3 Limitations

All processes that can compromise the oxide layer such as forming, or heat-treatment shall be performed prior to surface preparation of the parts to be oxidized.

Oxidizing should not be applied:

- in zones/areas ensuring electric conductivity;