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Electrodeposited coatings – Electroplated coatings of aluminium and aluminium alloys with supplementary treatment – Requirements and test methods

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15646

March 2009

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English Version

**Electrodeposited coatings - Electroplated coatings of aluminium
and aluminium alloys with supplementary treatment -
Requirements and test methods**

Revêtements électrolytiques - Dépôts électrolytiques
d'aluminium et d'alliages d'aluminium avec traitement
complémentaire - Exigences et méthodes d'essai

Galvanische Überzüge - Galvanische Aluminium- und
Aluminium-Legierungs-Überzüge mit zusätzlicher
Behandlung - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 14 February 2009.

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Foreword

This document (EN 15646:2009) has been prepared by Technical Committee CEN/TC 262 “Metallic and other inorganic coatings”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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Introduction

Electroplating of aluminium and aluminium alloy coatings provides several advantages:

- coating temperature (approximately 80 °C to 100 °C);
- no hydrogen embrittlement due to the electrodeposition of aluminium.

Prevention of hydrogen embrittlement results from the (process) technology of electroplating, because it is conducted in aprotic, organic solvents, in which the aluminium is dissolved as an aluminium-organic complex. To protect these electroplating solutions from humidity (water) and air oxygen, the electroplating of aluminium is performed under an inert gas atmosphere of nitrogen or argon. For anodic material aluminium is used, which has a purity of > 99,7 %. During electroplating of aluminium a purification (electrolytic refining) takes place, which results in an aluminium coating with a purity of 99,99 % Al percentage by mass. The high level of purity of the aluminium forms the basis for corrosion protection. The corrosion protection of the aluminium coating can be increased by common procedures of aluminium after-treatment, e.g. conversion coatings. The corrosion behaviour in chlorine-containing media is based on the fact that pure aluminium has a low self-corrosion because the aluminium is passivated by a thin oxide layer due to air oxygen. The oxide layer of the pure-aluminium coating is stable in the pH range from 4,0 to 8,5. Corrosion damage does not result in voluminous corrosion products.

The electrodeposited aluminium coatings cathodically protect iron materials. However, polarization effects in chlorine-free media, e.g. condensed water, may result in an anodic protective behaviour in such electrolytes. This effect can be reduced by alloying, for example, zinc or magnesium to the aluminium. Due to low dissolution current densities and extensive freedom of pores, the coatings can be suitable as galvanic corrosion protection on less reactive (more precious) materials like stainless steels and copper alloys. For adhesion reasons the application of a nickel strike may become necessary.

High ductility of the coatings allows an extreme deformation of the work pieces in the electroplated state.

The European Committee for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning the use of individual electrolyte (electroplating solution) formulations to electrodeposit aluminium and/or aluminium alloys as given in Subclause 3.2 and Annex C. CEN takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured CEN that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with CEN. Information may be obtained from:

Aluminal Oberflächentechnik GmbH & Co.KG
Auf der Birke 2
D-56412 Heiligenroth

Rasant-Alotec Beschichtungstechnik GmbH
Zur Kaule 1
D-51491 Overath

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WARNING — When using this standard, the legal safety regulations, e.g. ordinance on hazardous substances, list of MAC values, list of the values of technical limit concentration (TRK-Werte) and other technical regulations, shall be observed.

1 Scope

This European Standard specifies requirements for electrodeposited aluminium and aluminium alloy coatings on iron materials, plastic substrates, titanium materials, nickel materials and non-metallic substrate materials rendered conductive, such as plastics. The coatings serve either as corrosion or galvanic corrosion protection, as well as for other technical applications.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10025-2, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*

EN 12487:2000, *Corrosion protection of metals – Rinsed and non-rinsed chromate conversion coatings on aluminium and aluminium alloys*

EN 12508:2000, *Corrosion protection of metal and alloys – Surface treatment, metallic, and other inorganic coatings – Vocabulary*

EN 12540, *Corrosion protection of metals – Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and copper plus nickel plus chromium*

EN ISO 2819:1994, *Metallic coatings on metallic substrates – Electrodeposited and chemically deposited coatings – Review of methods available for testing adhesion (ISO 2819:1980)*

EN ISO 4527, *Metallic coatings – Autocatalytic (electroless) nickel-phosphorous alloy coatings – Specification and test methods (ISO 4527:2003)*

EN ISO 9227:2006, *Corrosion tests in artificial atmospheres – Salt spray tests (ISO 9227:2006)*

EN ISO 10289, *Methods for corrosion testing of metallic and other inorganic coatings on metallic substrates – Rating of test specimens and manufactured articles subjected to corrosion tests (ISO 10289:1999)*

EN ISO 11130:1999, *Corrosion of metals and alloys – Alternate immersion test in salt solution (ISO 11130:1999)*

ISO 554:1976, *Standard atmospheres for conditioning and/or testing – Specifications*

ISO 4519, *Electrodeposited metallic coatings and related finishes – Sampling procedures for inspection by attributes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12508:2000 and the following apply.

3.1

aprotic solution

solution using non-aqueous inert solvent

EXAMPLE Aromatic hydrocarbons.