Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion

1 SCOPE AND FIELD OF APPLICATION

This International Standard describes methods of checking the adhesion of electrodeposited and chemically deposited coatings. It is limited to tests of a qualitative nature. Table 2 indicates the suitability of each test for some of the most usual types of metallic coatings. Most of the tests described are capable of destroying both the coating and the article being tested, but some destroy the coating only. Even if the adhesion of the coating is found to be satisfactory on articles not destroyed in testing, it should not be assumed that the articles are undamaged. For example, the burnishing test (see 2.1) may render an article unacceptable and the thermal shock test (see 2.12) may produce unacceptable metallurgical changes.

This International Standard does not describe certain tests which have been developed at various times to give a quantitative measure of adhesion of metallic coating to a substrate since such tests require special apparatus and considerable skill in their performance which renders them unsuitable as quality control tests for production parts. Some of these quantitative tests may, however, be useful in research and development work.

When particular methods of adhesion testing are included in International Standards for individual coatings, they should be used in preference to the methods described in this International Standard and should be agreed upon beforehand by the supplier and the purchaser.

2 METHODS OF TEST

2.1 Burnishing test

If plated parts are subjected to burnishing in a localized area, the deposit will tend to work-harden and absorb frictional heat. If the coating is thin, separation of the coating from the basis metal as blisters will occur under these conditions in areas of poor adhesion.

When the shape and size of the part permit, an area of not more than 6 cm^2 of the plated surface should be rubbed with a smooth implement for about 15 s. A suitable implement is a steel rod 6 mm in diameter with a smooth hemispherical end.

The pressure shall be sufficient to burnish the coating at every stroke but not so great as to cut the coating. Poor adhesion is indicated by the appearance of a blister which grows as the rubbing is continued.

If the mechanical properties of the coating are poor, the blister may crack and the coating will peel from the basis metal. This test shall be limited to relatively thin deposits.

2.2 Ball burnishing test

Ball burnishing is frequently used for polishing, but it can be used also to test adhesion. Using a barrel or vibratory burnisher with steel balls about 3 mm in diameter and soap solution as lubricant, it is possible to produce blisters when the adhesion is very poor. The method is suitable for relatively thin deposits.

2.3 Shot peening test

There are some variations of the principle by which the hammering action of iron or steel balls, allowed to fall by gravity or forced by means of a pressure air stream onto the surface to be tested, produces deformation of the deposit.

If the coating is poorly bonded, it will become blistered. Usually, the intensity of peening necessary to cause non-adherent coatings to blister varies with the coating thickness, thin coatings requiring less than thick coatings.

One test can be performed using a tube 150 mm long, 19 mm internal diameter, as the reservoir for round iron or steel shot (0,75 mm diameter approximately) connected to a nozzle. Compressed air is brought to the apparatus with a pressure of 0,07 to 0,21 MPa[1)] and the distances between nozzle and specimen are 3 to 12 mm.

Another test, that appears to be the most suitable for checking the adhesion of electroplated coatings of silver during production of coatings from 100 to 600 µm in thickness, is described in the annex and employs a standard air-operated cabinet of the type used for shot-peening steel parts.

If the silver is poorly bonded, it will extend or flow and become blistered.

2.4 Peel test

This test is suitable for coatings less than 125 µm thick on substantially flat surfaces. A strip of tinned mild steel or brass, approximately 75 mm long × 10 mm wide × 0,5 mm thick, is bent at right angles 10 mm from one end and the

1) 1 MPa = 1 MN/m^2

Metallic Coatings On Metallic Substrates

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UNE-EN ISO 2819:1996 ,2017 **UNE-EN ISO 2819:2018** ,2018 **Metallic Coatings on Metallic Substrates** ,1995 Metallic Coatings on Metallic Substrates Standards South Africa,2007 **Metallic Coatings on Metallic Substrates** South African Bureau of Standards,1993 Methods for Corrosion Testing of Metallic and Other Inorganic Coatings on Metallic Substrates. Rating of Test Specimens and Manufactured Articles Subjected to Corrosion Tests British Standards Institute Staff,2001-05-15 Corrosion tests Physico chemical methods Corrosion resistance Metal coatings Protective coatings Non metallic coatings Coated materials Metals Ratings Test specimens Test equipment Decorative coatings Panels Corrosion environments Environmental testing Accelerated corrosion tests Accelerated testing **Metallic Coatings for Corrosion Control** V. E. Carter,2013-10-22 Metallic Coatings for Corrosion Control describes how metal coatings can control corrosion the selection process preparations suitability limitations and how coatings are applied The book reviews the nature of corrosion the forms of corrosion even general uneven general even local narrow pits cracking electrochemical mechanism of corrosion effects of discontinuities in coatings and economic considerations of coating It describes pretreatments such as removal of superficial corrosion abrading polishing the coating processes molten or spray application chemical or vapor deposition diffusion coating and also coating performance The rate of corrosion on different metals such as aluminum cadmium copper gold silver or tin depends on the presence of an oxide film solubility electrodeposits or tarnish blackening Gold is resistant to corrosion and tarnishing except in aqua regia The book recommends the following when the engineer is selecting a type of coating the environment where it is exposed the service life required the substrate material shape or size of the article its decorative appeal mechanical factors and if there will be any subsequent fabrication The book is useful for students of civil structural and mechanical engineering Designers and technicians of industrial machinery or maritime equipment will also profit from reading it *Metallic Coatings on Metallic Substrates. Electrodeposited and Chemically Deposited Coatings. Review of Methods Available for Testing Adhesion* British Standards Institute Staff,1918-03-14 Coatings Chemical plating Grinding Peeling tests Thermal shock tests Chisels Mechanical testing Silver Electrolysis Cupping tests Surface treatment Erichsen cupping tests Test equipment Bend testing Tensile testing Electrodeposition Metal coatings Adhesion tests Wrapping tests Sawing Testing conditions Steels Metals Peening **Polymetallic Coatings to Control Biofouling in Pipelines** Vinita Vishwakarma,Dawn S S,K. Gobi Saravanan,A. M. Kamalan Kirubaharan,Saravanamuthu Vigneswaran,Gayathri Naidu,2021-09-13 Most of the pipelines used for the transport of various fluids are susceptible to the formation of biofilms and the undesirable accumulation of microorganisms in pipelines leads to biodeterioration and increases the maintenance cost of the pipelines This book focuses on nanostructured polymetallic coatings for corrosion and biofouling protection in offshore oil and gas pipelines marine pipelines ship structures and port facilities and corrosion resistance surfaces of several engineered structures Considering

various reasons of biofouling in pipelines that transport crude and refined petroleum gas biofuels and other fluids including sewage slurry and water for drinking or irrigation the underlying mechanism is thoroughly explained A comparison of various protective techniques is also highlighted for the choice of methods for specific applications Features Provides information on biofouling control with broad significance and applicability in various industrial and research areas Discusses microbially induced corrosion on biofuel transporting pipelines Includes data from experiments conducted to overcome biofouling and biocorrosion Gives out particular attention to metallic coatings and environmental considerations Explores novel technologies preventing biofouling on metallic and polymeric substrates This book is for researchers and graduate students in Coatings and Paints Microbiology Bioprocess Engineering Biotechnology Industrial Engineering Mechanical and Chemical Engineering Marine Engineering Surface and Corrosion Engineering and Water and Wastewater Treatment **Low Absorptance Metallic Coatings for Metallic Substrates** John R. Kurdock,PERKIN-ELMER CORP NORWALK CONN ELECTRO-OPTICAL DIV.,1974 The program resulted in producing the fabrication technology that is required for high energy 10 6 micrometer laser programs now underway Polishing and coating techniques for metallic substrates were developed and the deposition of metallic coatings to reproducibly create metal mirror surfaces with low absorptance of a wavelength of 10 6 micrometer was investigated The basic task was one of expanding and transferring to metal substrates the technology developed by Bennett and Ashley for fused silica substrates Metal substrates of molybdenum TZM and beryllium copper were polished to a surface roughness of from 12 A to 15 A rms and overcoated with ultra high vacuum silver and ggold Absorption coefficients obtained were as low as 0 0064 The basic finishing technique that is now employed is acid etch stress relieving and controlled grinding modified conventional polishing techniques sputtering of similar metallic film and modified conventional polishing Modified author abstract **Coatings for High-Temperature Structural Materials** National Research Council,Division on Engineering and Physical Sciences,National Materials Advisory Board,Commission on Engineering and Technical Systems,Committee on Coatings for High-Temperature Structural Materials,1996-06-13 This book assesses the state of the art of coatings materials and processes for gas turbine blades and vanes determines potential applications of coatings in high temperature environments identifies needs for improved coatings in terms of performance enhancements design considerations and fabrication processes assesses durability of advanced coating systems in expected service environments and discusses the required inspection repair and maintenance methods The promising areas for research and development of materials and processes for improved coating systems and the approaches to increased coating standardization are identified with an emphasis on materials and processes with the potential for improved performance quality reproducibility or manufacturing cost reduction **Micro and Precision Manufacturing** Kapil Gupta,2017-10-15 This book provides details on various micro and precision manufacturing and finishing operations performed by conventional and advanced processes including micro manufacturing of micro tools and precision finishing of engineered components It describes the process

mechanism principles and parameters while performing micro fabrication and precision finishing operations The text provides the readers with knowledge of micro and precision manufacturing and encourages them to explore the future venues in this field **Method of Forming Metallic Coatings on Polymeric Substrates** ,1984 Very smooth polymeric coatings or films graded in atomic number and density an readily be formed by first preparing the coating or film from the desired monomeric material and then contacting it with a fluid containing a metal or a mixture of metals for a time sufficient for such metal or metals to sorb and diffuse into the coating or film Metal resinate solutions are particularly advantageous for this purpose A metallic coating can in turn be produced on the metal loaded film or coating by exposing it to a low pressure plasma of air oxygen or nitrous oxide The process permits a metallic coating to be formed on a heat sensitive substrate without the use of elevated temperatures **Metallic Coatings. Determination of Porosity on Gold Coatings on Metallic Substrates. Nitric Acid Vapour Test** British Standards Institute Staff,2000-05-15 Metal coatings Decorative coatings Gold Thickness Porosity measurement Porosity Electrodeposition Nitric acid Chemical analysis and testing Test equipment Coatings **The Surface Treatment and Finishing of Aluminium and Its Alloys** Simon Wernick,Robert Pinner,P. G. Sheasby,1987 Metallic and Non-Organic Coatings on Metallic Substrates. Saline Droplets Corrosion Test (SD Test) B. S. 5466:part 9:1986,British Standards Institute Staff,1986-12-31 Metal coatings Coatings Conversion coating Metals Accelerated corrosion tests Salt spray tests Corrosion tests Test equipment Specimen preparation Testing conditions **ASTM Standards for Corrosion Testing of Metals** American Society for Testing and Materials,1990 **Notes on Metal Coating Technology (Applied Engineering)** Henry Leidheiser, Jr.,2009-09-01 A practical and concise approach Topics include metallic coatings commonly used surface preparation methods methods of applying coatings evaluation of surface character prior to coating application methods for measuring chemical and physical properties of coatings selection of coating type and application method corrosion principles metallic coatings on non metallic substrates polymer science as it relates to coatings common organic coatings methods of applying organic coatings compatibility of organic coatings corrosion of painted metals accelerated corrosion testing and the removal of coatings from metals Handbook of Sol-Gel Science and Technology Lisa Klein,Mario Aparicio,Andrei Jitianu,2018-05-31 This completely updated and expanded second edition stands as a comprehensive knowledgebase on both the fundamentals and applications of this important materials processing method The diverse international team of contributing authors of this reference clarify in extensive detail properties and applications of sol gel science and technology as it pertains to the production of substances active and non active including optical electronic chemical sensor bio and structural materials Essential to a wide range of manufacturing industries the compilation divides into the three complementary sections Sol Gel Processing devoted to general aspects of processing and recently developed materials such as organic inorganic hybrids photonic crystals ferroelectric coatings and photocatalysts Characterization of Sol Gel Materials and Products presenting contributions that highlight the notion that

useful materials are only produced when characterization is tied to processing such as determination of structure by NMR in situ characterization of the sol gel reaction process determination of microstructure of oxide gels characterization of porous structure of gels by the surface measurements and characterization of organic inorganic hybrid and Applications of Sol Gel Technology covering applications such as the sol gel method used in processing of bulk silica glasses bulk porous gels prepared by sol gel method application of sol gel method to fabrication of glass and ceramic fibers reflective and antireflective coating films application of sol gel method to formation of photocatalytic coating films and application of sol gel method to bioactive coating films The comprehensive scope and integrated treatment of topics make this reference volume ideal for R D scientists and engineers across a wide range of disciplines and professional interests *Green Tribology, Green Surface Engineering, and Global Warming* Ramnarayan Chattopadhyay,2014-01-01 This book describes green engineering concepts to improve energy efficiency by reducing energy losses due to friction and wear in metalworking operations and by extending component life

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