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Corrosion of metals and alloys — Method of measuring the pitting potential for stainless steels by potentiodynamic control in sodium chloride solution

Corrosion des métaux et alliages — Méthode de mesure du potentiel de piqûre des aciers inoxydables par contrôle potentiodynamique en solution de chlorure de sodium

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 156, *Corrosion of metals and alloys.*

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Introduction

Although stainless steel is generally used as a corrosion-resistant material, it is susceptible to pitting corrosion, crevice corrosion, stress corrosion cracking, etc. Among those, pitting corrosion is one of the most common phenomena that occur on stainless steels. A commonly used parameter to evaluate the pitting corrosion resistance of stainless steel, is so-called pitting potential that defines the lowest potential below which stables pits are not considered to grow. Since pitting corrosion generally shows a stochastic nature dependent upon inhomogeneity in terms of size, orientation, alloying components, impurity, inclusions, segregation, surface treatment, history, elapsed time, fluctuation of environment, etc., its measurement requires at least a couple of values.

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Corrosion of metals and alloys — Method of measuring the pitting potential for stainless steels by potentiodynamic control in sodium chloride solution

1 Scope

This International Standard describes the procedure for determining the pitting potential for stainless steels (austenitic, ferritic/austenitic, ferritic, martensitic stainless steel) under potentiodynamic control.

The principal advantage compared with other potentiostatic test methods[1][2] is the rapidity of this test method, with which the pitting potential can be measured in a single potential scan.

The pitting potential as determined by this International Standard can be used as a relative index of performance. For example, one can compare the relative performances for different lots of stainless-steel grades and products. The test described in this International Standard is not intended to determine the pitting potential at which actual pitting can occur under real service conditions, or not.

2 Principle

The test involves increasing the anodic potential of the specimen at a specified scan rate while exposing the specimen to a normalized sodium chloride solution at a constant temperature.

The pitting potential (V'_{c10} or V'_{c100}) (see JIS G 0577[3]) is defined as the potential at which the current density exceeds 10 μA/cm^2 or 100 μA/cm^2 for more than 60 s. A 60 s delay is used in order to ensure that the observed current increase originates from stably propagating pitting, since short-lived current peaks originate from metastable pitting.

The specimen holder and the specimen itself are designed to ensure that crevice corrosion does not occur.

3 Apparatus

3.1 Potentiostat

The potentiostat shall be capable of controlling the electrode potential to within ±1 mV of a preset value.

3.2 Electrode potential-measuring instrument

The instrument shall have high input impedance sufficient to eliminate potential read error due to current drawn by the instrument during measurement; impedance of the order of 10^{11} Ω to 10^{14} Ω is typical. The sensitivity and accuracy of the instrument should be sufficient to detect a change of 1,0 mV.

3.3 Current-measuring instruments

The current in the circuit is evaluated from the potential drop measured across a known resistor. In many potentiostats, this measurement is made internally. But measurements may also be made externally by locating a resistor in the current line from the auxiliary electrode to the auxiliary connection of the potentiostat. The instrument shall be capable of measuring a current within 2 % error around the actual value.

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