Designation: B457 – 67 (Reapproved 2013)

Standard Test Method for Measurement of Impedance of Anodic Coatings on Aluminum[1]

This standard is issued under the fixed designation B457; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method describes the conditions and equipment for measuring the impedance of anodic coatings on aluminum. Such measurements have been used to evaluate the quality of seal of an anodic coating. The test method does not prescribe the procedure for producing the anodic coating, nor the postanodizing treatment usually described as "sealing."

1.2 This test method is applicable to the rapid, nondestructive testing of anodic coatings. The interpretation of results and correlation of data with service experience and other tests are not within the scope of this test method.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Nature of Test

2.1 Impedance is an electrical characteristic described as the total opposition of all circuit elements to the flow of alternating current. Inductive effects of anodic coatings are negligible and the impedance is presumed to be made up of resistance and capacitive reactance according to the following relationships:

$$Z = \sqrt{R^2 + X_c^2} \tag{1}$$

and

$$X_c = 1/2\,\pi f C \tag{2}$$

where:

Z = impedance,
R = resistance,
X_c = capacitive reactance,
f = frequency, and
C = capacitance.

2.2 Both resistance and capacitance are associated with a material constant and a geometric factor:

$$R - r\,(l/A) \tag{3}$$

where:

R = resistance,
r = specific resistance,
l = length of conductor, and
A = area of cross section of conductor.

$$C = e(A/l) \tag{4}$$

where:

C = capacitance,
e = dielectric constant,
A = area of opposing plates of capacitor, and
l = distance between plates.

2.3 For measuring impedance of anodic coatings, the material constants are partly associated with the anodic coating and partly with the electrolyte employed in the test cell. For simplification these constants are assumed not to vary. The variations in measured impedance then depend directly on geometric factors.[2]

3. Apparatus

3.1 *Impedance Bridges*—Commercially available a-c impedance bridges with the following characteristics are satisfactory:[3]

3.1.1 *Range*—1 μF (1000 nF) to 0.0001 μF (0.1 nF) full scale with a dissipation factor of 0 to 2.

[1] This test method is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.07 on Conversion Coatings.

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[2] The Alcoa Impedance Test for Anodic Coatings (AZTAC) evaluates a 0.129-cm^2 (0.02-in.^{2}) test area and expresses impedance in kilohms. Instructions are available from Alcoa Process Development Laboratories, P.O. Box 2970, Pittsburgh, PA 15230.

[3] The Z-Scope, formerly manufactured by Twin City Testing Corp., Tonawanda, NY was designed to measure the impedance of anodic coatings on aluminum. AZTAC values (the impedance of a 0.129-cm^2 (0.02-in.^{2}) test area) can be read directly in kilohms with this instrument.