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Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape

ABSTRACT

Revised in 2016! This NACE International standard practice describes and characterizes one procedure for measuring the surface profile of abrasive blast cleaned steel. The measurement technique uses a tape that replicates the surface profile. Other common methods of measuring surface profile are not discussed. The standard covers the areas of equipment and procedures, provides a definition of "surface profile," and includes an appendix that presents the results of a round-robin series of measurements illustrating the degree of accuracy of the procedure described in the standard. A second appendix statistically summarizes the data presented in the first appendix. This revision takes into account a chemical reformulation and associated modification to the manufacturer's instructions for use of replica tape that occurred in 2010.

KEYWORDS

abrasive blast cleaned steel, ISO 8503-5, micrometer gauge, replica tape, surface profile, TG 419

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In NACE standards, the terms shall, must, should, and may are used in accordance with the definitions of these terms in the NACE Publications Style Manual, 4th ed., Paragraph 7.4.1.9. Shall and must are used to state mandatory requirements. The term should is used to state something considered good and is recommended but is not mandatory. The term may is used to state something considered optional.

Foreword

Before the application of protective coatings to steel surfaces, the surfaces are frequently cleaned by abrasive impact. Such abrasive cleaning roughens the steel surface, assuring a surface profile (also known as an anchor pattern, anchor profile, or anchor-tooth profile). The resulting degree of surface roughness is affected by many variables, including the type, size, and shape of the abrasive used, its velocity and angle of impact, etc. This surface profile enhances coating adhesion.

Many techniques and instruments are currently used to measure the surface texture or surface profile; however, those providing the highest degree of precision are suitable only for use in a laboratory. Because a surface profile range is frequently specified and the recommended surface profile is different for various types of coatings, a means to measure surface profile at the work site is desirable.

The purpose of this NACE International standard practice is to describe and characterize one procedure for measuring the surface profile of abrasive blast cleaned steel. The measurement technique uses a tape that replicates the surface profile. The thickness of the tape (with the profile replicate) is then measured with a micrometric thickness gauge to determine the surface profile. Other common methods of measuring surface profile are not discussed.

The procedure described in this standard is limited to the measurement of the surface profile with a profile defined as 20 to 115 µm (0.8 to 4.5 mil) and prepared to a white metal,[1] near-white metal,[2] or commercial blast-cleaned[3] surface finish.

The determination of surface profile depends on its definition. This procedure determines the surface profile only as it is defined in this standard (see Paragraph 2.1). If the surface profile is defined differently, the data presented in this standard may not be representative of user results. Individual measurements of the surface profile of an abrasive blast-cleaned metal surface vary significantly from area to area over a given surface.

Appendix A (Nonmandatory) presents the results of a round-robin series of measurements by several individuals, and illustrates the degree of accuracy of the procedure described in this standard over a part of the method's range. Appendix B (Nonmandatory) statistically summarizes the data shown graphically in Appendix A. Panels used in the tests shown in Appendix A were hot-rolled and nonrusted. The extraneous profile of severely rusted surfaces reduces the accuracy of the procedure. Measurements were taken on relatively flat areas where the surface appeared to be continuous and uniform.

This standard is intended for use by personnel who have a requirement to measure the surface profile of abrasive blast-cleaned steel using replica tape before applying a protective coating. This revision takes into account a chemical reformulation and associated modification to the manufacturer's instructions for use of replica tape that occurred in 2010.

This standard was originally prepared in 1987 by NACE Task Group T 6G 19, a component of Unit Committee T 6G, "Surface Preparation for Protective Coatings." The standard was reaffirmed in 1991 and 1995 by Unit Committee T-6G, and in 2002 by Specific Technology Group (STG) 04, "Protective Coatings and Linings—Surface Preparation." The NACE standard was revised in 2016 by TG 419 (formerly T-6G-19), which is administered by STG 04; and sponsored by STG 02, "Coatings and Linings, Protective—Atmospheric; and STG 03, "Coating and Linings, Protective—Immersion and Buried Service." This standard is issued by NACE under the auspices of STG 04.

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Figures

Section 1: General

1.1 This standard describes a procedure using replica tape for on site measurement of the surface profile of abrasive blast-cleaned steel surfaces that have a surface profile of 20 to 115 µm (0.8 to 4.5 mil), as defined in Section 2. The procedure has been demonstrated to correlate well with the measurements obtained by the defined laboratory procedure on nonrusted panels prepared in accordance with the specifications of NACE No. 1/SSPC[(1)]-SP 5[1] (White Metal), NACE No. 2/SSPC-SP 10[2] (Near-White Metal), or NACE No. 3/SSPC-SP 6[3] (Commercial Blast-Cleaned). Measurements obtained using replica tape have similarly been shown to correlate closely with profile measurments obtained using electronic stylus surface roughness testers.[4]

Section 2: Definitions

2.1 **Surface Profile:** the irregular peak and valley profile on a bare surface that can result from operations such as abrasive blast cleaning or power tool cleaning. [Also called anchor pattern.] For the purposes of this standard, surface profile is defined as that value obtained when the peak-to-valley profile of a surface is measured using an optical microscope as described in NACE Publication 6G176.[4]

The laboratory procedure described in NACE Publication 6G176 involves averaging a statistically significant number of readings (20 to 30) using an optical microscope, magnification of 250X to 280X, with a field of 0.41 to 0.46 mm (0.016 to 0.018 in) diameter, and recording the distance measured from the top of the highest peak to the bottom of the lowest valley in the field of view.

Section 3: Introduction

3.1 **Replica Tape**

3.1.1 Replica tape consists of a layer of crushable plastic microfoam coated onto an incompressible polyester substrate having a thickness of 51 µm ± 2 µm (2.0 mil ± 0.1 mil). Square pieces of this film measuring at least 10 mm (0.4 in) on each side are affixed to circular cut-outs in strips of adhesive-backed paper tape. The purpose of the adhesive-backed paper tape is to allow inspectors to secure the tape to the surface to be measured.

3.1.2 Replica tape is available in two principal grades (or thicknesses), Coarse and X-Coarse. Together, the two grades permit measurement of the profile within the method's primary range of 20 to 115 µm (0.8 to 4.5 mil). The Coarse grade covers the lower end and X-Coarse grade covers the higher end of the range. There is a range overlap window between the two that extends from 38 to 64 µm (1.5 to 2.5 mil).

3.1.3 Coarse Minus-grade replica tape is a check grade used to confirm measurements near the lower end (approximately 20 µm [0.8 mil]) of the primary range.

3.1.4 X-Coarse Plus-grade tape is a check grade used to confirm measurements near the higher end (approximately 115 µm [4.5 mil]) of the primary range.

3.2 A micrometric thickness gauge specifically identified as being suitable for use with replica tape.

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(1) SSPC: The Society for Protective Coatings, 800 Trumbull Drive, Pittsburgh, PA 15205.