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Standard Practice for Determination of Chromium Treatment Weight on Metal Substrates by X-Ray Fluorescence[1]

This standard is issued under the fixed designation D5723; 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 practice covers the use of X-ray fluorescence (XRF) techniques for determination of the coating weight of chromium treatments on metal substrates. These techniques are applicable for determination of the coating weight as chromium or total coating weight of a chromium-containing treatment, or both, on a variety of metal substrates.

1.2 *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. Summary of Practice

2.1 *Excitation*—The measurement of chromium treatment coating weights by XRF methods is based on the combined interaction of the chromium coating and substrate with an intense beam of primary radiation. Since each element fluoresces at an energy characteristic of the particular element, this interaction results in the generation of X rays of defined energy. The primary radiation may be generated by an X-ray tube or derive from a radioisotope.

2.2 *Detection*—The secondary beam (fluorescent X rays of the elements and scattered radiation) is read by a detector that can discriminate between the energy levels of fluorescing radiations in the secondary beam. The detection system includes the radiation detector with electronics for pulse amplification and pulse counting.

2.3 *Basic Principle:*

2.3.1 A relationship exists between the treatment coating weight and secondary radiation intensity. This relationship is usually linear within the desired coating weights of the chromium treatments on metal substrates. The measurements are based on primary standards of known coating weights and instrument calibration that correlates the secondary radiation intensity with the coating weight quantitatively.

2.3.2 The coating weight is determined by measurement of the fluorescent X rays of the coating. The detection system is set to count the number of X rays in an energy region that is characteristic of X rays from the element of interest. The element of interest in this practice is chromium.

2.3.3 If a linear relationship exists, the coating weight and number of counts of X rays of a chromium treatment on a particular substrate can be expressed by a conversion factor that represents the number of counts for a particular coating weight unit/unit area. This is usually expressed in mg/ft^2 or mg/m^2 of chromium or total coating weight.

2.3.4 The exact relationship between the measured number of counts and corresponding coating weight must be established for each individual combination of substrate and chromium-containing treatment. Usually determined by the treatment supplier, this relationship is established by using primary standards having known amounts of the same treatment applied to the same substrate composition as the specimens to be measured.

2.3.5 Some X-ray apparatus have a data handling system whereby a coating weight versus X-ray counts curve may be established within the system for the direct readout of coating weight. If such apparatus does not permit the entry of a conversion factor as described in 2.3.3, it is calibrated using a bare, untreated specimen and a minimum of three specimens with known coating weights of the treatment and substrate combination of interest. The coating weight to be measured must be within the range of these known coating weights. More than three known specimens must be used if the relationship of X-ray counts to coating weight is

[1] This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.53 on Coil Coated Metal.

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