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Standard Guide for Metals Identification, Grade Verification, and Sorting[1]

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1. Scope

1.1 This guide is intended for tutorial purposes only. It describes the general requirements, methods, and procedures for the nondestructive identification and sorting of metals.

1.2 It provides guidelines for the selection and use of methods suited to the requirements of particular metals sorting or identification problems.

1.3 *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.* For specific precautionary statements, see Section 10.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

E 158 Practice for Fundamental Calculations to Convert Intensities into Concentrations in Optical Emission Spectrochemical Analysis

E 305 Practices for Establishing and Controlling Spectrochemical Analytical Curves

E 322 Method for X-Ray Emission Spectrometric Analysis of Low-Alloy Steels and Cast Irons

E 566 Practice for Electromagnetic (Eddy-Current) Sorting of Ferrous Metals

E 572 Test Method for X-Ray Emission Spectrometric Analysis of Stainless Steel

E 703 Practice for Electromagnetic (Eddy Current) Sorting of Nonferrous Metals

E 977 Practice for Thermoelectric Sorting of Electrically Conductive Materials

F 355 Test Method for Shock Absorbing Properties of Playing Surface Systems and Materials

F 1156 Terminology Relating to Product Counterfeit Protection Systems

3. Terminology

3.1 *Definitions*—Terms used in this guide are defined in the standards cited in Section 2 and in current technical literature or dictionaries; however, because a number of terms that are used generally in nondestructive testing have meanings or carry implications unique to metal sorting, they appear with explanation in Appendix X1.

4. Significance and Use

4.1 A major concern of metals producers, warehouses, and users is to establish and maintain the identity of metals from melting to their final application. This involves the use of standard quality assurance practices and procedures throughout the various stages of manufacturing and processing, at warehouses and materials receiving, and during fabrication and final installation of the product. These practices typically involve standard chemical analyses and physical tests to meet product acceptance standards, which are slow. Several pieces from a production run are usually destroyed or rendered unusable through mechanical and chemical testing, and the results are used to assess the entire lot using statistical methods. Statistical quality assurance methods are usually effective; however, mixed grades, off-chemistry, and nonstandard physical properties remain the primary causes for claims in the metals industry. A more comprehensive verification of product properties is necessary. Nondestructive means are available to supplement conventional metals grade verification techniques, and to monitor chemical and physical properties at selected production stages, in order to assist in maintaining the identities of metals and their consistency in mechanical properties.

4.2 Nondestructive methods have the potential for monitoring grade during production on a continuous or statistical basis, for monitoring properties such as hardness and case depth, and for verifying the effectiveness of heat treatment, cold-working, and the like. They are quite often used in the field for solving problems involving off-grade and mixed-grade materials.

4.3 The nondestructive methods covered in this guide provide both direct and indirect responses to the sample being evaluated. Spectrometric analysis instruments respond to the presence and percents of alloying constituents. The electromagnetic (eddy current) and thermoelectric methods, on the other hand, are among those that respond to properties in the sample that are affected by chemistry and processing, and they

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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