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Standard Guide for Formats for Collection and Compilation of Corrosion Data for Metals for Computerized Database Input[1]

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1. Scope

1.1 This guide defines the data categories and specific data elements (fields) considered necessary to accommodate desired search strategies and reliable data comparisons in computerized corrosion databases. The data entries are designed to accommodate data relative to the basic forms of corrosion and to serve as guides for structuring multiple source database compilations capable of assessing compatibility of metals and alloys for a wide range of environments and exposure conditions.

2. Referenced Documents

2.1 *ASTM Standards:*

E 8 Test Methods for Tension Testing of Metallic Materials[2]

E 527 Practice for Numbering Metals and Alloys (UNS)[3]

E 1314 Practice for Structuring Terminological Records Relating to Computerized Test Reporting and Materials Designation Formats[4]

E 1338 Guide for the Identification of Metals and Alloys in Computerized Material Property Databases[4]

G 1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens[5]

G 15 Terminology Relating to Corrosion and Corrosion Testing[5]

G 34 Test Method for Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)[5]

G 46 Guide for Examination and Evaluation of Pitting Corrosion[5]

G 49 Practice for Preparation and Use of Direct Tension Stress-Corrosion Test Specimens[5]

G 78 Guide for Crevice Corrosion Testing of Iron-Base and Nickel-Base Stainless Alloys in Seawater and Other Chloride-Containing Aqueous Environments[5]

3. Terminology

3.1 *Definitions*—For definitions of terms applicable to this guide see Practice E 1314 and Terminology G 15.

4. Significance and Use

4.1 The guide is intended to facilitate the recording of corrosion test results and does not imply or endorse any particular database design or schema. It provides a useful reference to be consulted before initiating a corrosion test to be sure plans are made to record all relevant data.

4.2 Corrosion tests are usually performed following a prescribed test procedure that is often not a standard test method. Most corrosion tests involve concurrent exposure of multiple specimens of one or more materials (refer to 6.1.1).

4.3 This guide is designed to record data for individual specimens with groupings by separate tests (as contrasted to separate test methods) as described in 4.2 and 6.1.1. Consequently, some of the individual fields may apply to all of the specimens in a single test, while others must be repeated as often as necessary to record data for individual specimens.

4.4 The guidelines provided are designed for recording data for entry into computerized material performance databases. They may be useful for other applications where systematic recording of corrosion data is desired.

4.5 Reliable comparisons of corrosion data from multiple sources will be expedited if data are provided for as many of the listed fields as possible. Comparisons are possible where data are limited, but some degree of uncertainty will be present.

4.6 Certain specialized corrosion tests may require additional data elements to fully characterize the data recorded. This guide does not preclude these additions. Other ASTM guides for recording data from mechanical property tests may be helpful.

4.7 This guide does not cover the recording of data from electrochemical corrosion tests.

4.8 These material identification guidelines are compatible with Guidelines E 1338.

5. Categorization of Corrosion Data

5.1 This guide considers nine general categories for use in documenting corrosion data. Categories, with input examples, are as follows:

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[2] *Annual Book of ASTM Standards*, Vol 03.01.

[3] *Annual Book of ASTM Standards*, Vol 01.01.

[4] *Annual Book of ASTM Standards*, Vol 14.01.

[5] *Annual Book of ASTM Standards*, Vol 03.02.

5.1.1 *Test Identification*—Unique code to identify groupings of multiple specimens exposed at the same time and under identical conditions.

5.1.2 *Type of Test*—Standardized, laboratory, field tests; test relation to specific process or application (for example, sulfide stress cracking test for sour gas production tubing).

5.1.3 *Test Emphasis*—Specific form of corrosion or degradation (for example, pitting, corrosion-fatigue, crevice corrosion, etc.).

5.1.4 *Environment*—Generic description; identification, concentration, and state of principal components; contaminants, etc.

5.1.5 *Exposure Conditions*—Duration, temperature, pH, hydrodynamic conditions, aeration, etc.

5.1.6 *Material Identification*—Material class, subclass, and family, common name, standard designation, condition, manufacturing process, product form, etc.

5.1.7 *Specimen Identification*—Specimen number, size, geometry, surface condition, composition, properties.

5.1.8 *Specimen Performance*—Mass change, property change, performance relative to specific corrosion, or degradation mechanism.

5.1.9 *Data Source or Reference*.

5.2 This guide permits supplementary notes to document supplementary information considered important in interpreting data.

6. Data Searching

6.1 This guide considers data to accommodate searches for identifying and locating data and metadata in eight specific areas as follows:

6.1.1 Multiple specimens of one material included in same test (that is, exposed in same or companion test rack exposed under identical conditions in same or companion test vessel).

6.1.2 Different materials included in same test.

6.1.3 Material evaluated by specific standard test methods (by standardized test number).

6.1.4 Materials exposed to specific environments with environments defined by generic description (for example, sour gas) or by specific components (for example, hydrocarbon + H_2S).

6.1.5 Specific materials, defined by class (for example, metals), subclass (for example, wrought aluminum), family (for example, Al-Si alloys), standard designation (UNS No., ASTM specification), or common name.

6.1.6 Specific application or process (for example, sour gas production tubing, pulp bleaching).

6.1.7 Type of corrosion or degradation mechanism (for example, pitting, corrosion fatigue, etc.).

6.1.8 Results from a specific reference or source.

6.2 Additional information may be required to facilitate supplementary search requirements. This guide does not preclude these additions.

7. Data Entry Fields

7.1 Data entry fields are listed in Table 1. The table contains the following information:

7.1.1 The reference number is a unique number the first three digits of which refer to the relevant paragraph numbers in this guide.

7.1.2 The field name or object tag is a concise label for the field. Tags are made up of one or more character strings separated by periods. The first character in each string must be alphabetic (a–z, A–Z,"). Thereafter the characters may be alphanumeric (a–z, A–Z,", 0–9).

7.1.2.1 Periods are used to separate subdivisions inherent in the information, for example "Component.Name," "Component.Conc."

7.1.2.2 Tags are case insensitive although mixed case is suggested for readability. Mixed case is used when a tag's meaning forms a single concept, for example "FlowRegime."

7.1.3 The field description is a textual description of the field.

7.1.4 The field type describes the format and allowed contents for the field. The field may be one of the following types:

7.1.4.1 *String (STRING)*—A string is an undifferentiated series of characters. Strings may contain punctuation characters except for a tab, new line, or leading semicolon.

7.1.4.2 *Quantity (QUANT)*—A quantity is a data aggregate made of a real number and a unit. The last column of the table gives suggested units for the field. Alternative units may be used.

7.1.4.3 *Data (DATE)*—A date is a string of eight numeric characters encoding year, month, and day in the order YYYYMMDD.

7.1.4.4 *Time (TIME)*—A time is a string of six numeric characters encoding hour, minute and second in the order HHMMSS.

7.1.4.5 *Category Set (SET*—A category set is a closed list of values for a particular field. A database uses an integer value to record the member of the category set. Category sets should not be used for quantities. Use the quantity type, instead. The last column of the table gives a list of acceptable values and their meaning for each category set field.

7.1.4.6 *Tabular (TABLE)*—A tabular field is made up of a group of values. The last column gives the title and type of each value.

8. Keywords

8.1 computerization; corrosion; data; database; material performance; metal

TABLE 1 Standard Data Entry Fields for Corrosion Database Development

Reference Number	Field Name or Object Tag	Description	Field Type	Category Set/Suggested Units/Column Definition
5.1.1	TestNo	individual test number to identify grouping of specimens tested concurrently. See subsequent entries of test method	STRING	

TABLE 1 *Continued*

Reference Number	Field Name or Object Tag	Description	Field Type	Category Set/Suggested Units/Column Definition
		TYPE OF TEST		
5.1.2.1	Standard	standard test specification	STRING	
5.1.2.2	Location	field or laboratory test	SET	(1) F - field (2) L - Laboratory
5.1.2.3	Date	date test started	DATE	
		TEST EMPHASIS		
5.1.3.1	CorrosionType	type(s) of corrosion evaluated examples: general corrosion, stress corrosion, pitting, crevice corrosion, hot or cold wall effects, fretting, stray current, weld corrosion, corrosion-fatigue, galvanic corrosion, microbiological corrosion	STRING	
		CHEMISTRY OF ENVIRONMENT		
5.1.4.1	Environment	generic description of environment	STRING	
5.1.4.2	Component	component—common name	STRING	
5.1.4.3	Component.Registry	chemical abstracts registry number	STRING	
5.1.4.4	Component.Conc	concentration (liquids)	QUANT	g/L
5.1.4.5	Component.Press	partial pressure (gases)	QUANT	N/m^2, psi
5.1.4.6	Component.Form	component form	SET	(1) solid (2) liquid (3) gaseous (4) aqueous liquid (5) non-aqueous solutions or emulsions
5.1.4.7	IonicSpecies	ionic species	STRING	
5.1.4.8	Inhibitor	inhibitors Note: many environments contain multiple components. Reference numbers 5.1.4.1 through 5.1.4.8 should be repeated for each component and no restrictions should be placed on the number of components to be described for any given environment. <<<Needs resolution>>>	STRING	
		EXPOSURE CONDITIONS		
5.1.5.1	Duration	exposure duration	QUANT	days
5.1.5.2	MinTemp	temperature—min	QUANT	°C, °F
5.1.5.3	MaxTemp	temperature—max	QUANT	°C, °F
5.1.5.4	AvgTemp	temperature—av	QUANT	°C, °F
5.1.5.5	HeatTransfer	heat transfer between specimen and environment. If YES, describe conditions in 5.1.5.6	SET	(1) Y—yes (2) N—no
5.1.5.6	HeatTransfer.Description	heat transfer conditions	STRING	
5.1.5.7	MaxPH	pH—minimum	QUANT	
5.1.5.8	MinPH	pH—maximum	QUANT	
5.1.5.9	AvgPH	pH—avg	QUANT	
5.1.5.10	Alkalinity	total alkalinity (total concentration of bases)	QUANT	moles/l
5.1.5.11	Acidity	total acidity (total concentration of acids)	QUANT	moles/l
5.1.5.12	Conductivity	conductivity	QUANT	mhos/m
5.1.5.13	Pressure	pressure (absolute)	QUANT	Pa, psi
5.1.5.14	Velocity	velocity	QUANT	m/s, ft/s
5.1.5.15	ReynoldsNo	reynolds number	QUANT	
5.1.5.16	FlowRegime	flow	SET	(1) none (2) laminar (3) turbulent (4) forced convection
5.1.5.17	Geometry	system geometry at test sample	STRING	
5.1.5.18	Sparging	sparging	SET	(1) deaerated (vacuum, inert gas) (2) none—less than saturated (open to air) (3) air (4) oxygen (5) inert gas
5.1.5.19	Agitation	agitation	SET	(1) none (2) stirred (3) shaken (4) shaken but not bruised
5.1.5.20	ExpZone	exposure zone	SET	(1) continuous immersion (2) splash zone (3) waterline (4) condensate zone (5) gaseous phase (6) cyclic exposure describe in 5.1.5.21
5.1.5.21	ExpZone.Cycle	cyclic exposure cycle (immersion/air exposure, etc.)	STRING	