

Field exposure of metals

Important standards and additional procedures

ISO 8565

*Metals and alloys - Atmospheric corrosion testing -
General requirements for field tests*

Scope

- This International Standard establishes general requirements for stationary corrosion testing of metals and metallic coatings under atmospheric conditions carried out in the open air or under shelters

Requirements for test specimens, types

- Flat sheet specimens
 - A convenient specimen size is 150 mm x 100 mm. Specimens may be larger provided that they can be accurately evaluated.
 - The specimen thickness shall be adequate to ensure that the specimens will survive the intended test period (1 to 3 mm)
- Irregularly shaped specimens
 - bolts, tubes, rods, angles and even assemblies
 - The ends of tube specimens shall be sealed if corrosion of the outside surface only is of interest.
 - Complex specimens, such as assemblies, may contain crevices, water traps, weldments and dissimilar metals. It is therefore important to take account of the effects of these on the corrosion resistance of the assembly.
- Specimens with organic coating
 - The application of the coating shall follow the recommendation given in ISO 11944-4. To prevent corrosion effects at the edges the coated specimens shall be edge-protected with a durable thick coating along all edges.

Specimen preparation and handling

- Preparation
 - A well defined surface preparation is needed
 - Surface preparation may involve a combination of a degreasing stage using organic solvents or alkaline degreasing fluids and a mechanical or chemical descaling treatment for surfaces bearing mill scale, heat treatment scale or rust. Suitable descaling treatments for a wide range of metals are given in ISO 8407:1991
 - It is absolutely necessary to avoid cleaning methods which may attack the surface of test specimens.
- Handling
 - Limit the handling
 - Use clean gloves

Marking

- Marking shall be legible and durable over the whole period of exposure
- For metals stamping or drilled holes can be used
- For organic coated specimens the marking can be with permanent pen marker on the ground ward side to prevent the bleaching by solar radiation
- The establishment of a reliable map of specimen identity, exposure data and location on the exposure frame is recommended.

Specimens

- The number of test specimens of each type used in a given evaluation shall not be less than three for each exposure time interval.
- Control specimens are replicates of exposed test specimens which are stored under non corrosive conditions. They may be used to determine changes in physical and mechanical properties as a result of exposure of the specimens.
- Reference specimens: when testing new or modified materials, samples of the original (known) material are used for comparison purposes and exposed together with the test samples.

Storage

- During storage of the test specimens before exposure, and during storage of control specimens, care shall be taken to avoid mechanical damage and contact with other specimens. A room with a controlled temperature and a relative humidity of 65 % or less shall be used for storage purposes. Particularly sensitive specimens shall be stored in a desiccator or sealed in plastic bags with desiccant. (See ISO 4543)

Data records (metals)

- chemical composition
- mass
- shape and size
- surface finish characteristics
- heat treatment
- basic physical properties (mechanical, electrical or physico chemical) and surface roughness
- method of preparation of the test panels
- test method for the metal surface treatment
- specification of the metal according to relevant standards or trade marks
- specification of the test methods by which the individual properties were evaluated
- specification of the intermediate product from which the test panels were produced



*Atmospheric
corrosion
test sites*

Sheltered and unsheltered exposure

- It is recommended that the atmospheric corrosion test sites provide facilities for both
 - Open air exposure, i.e. direct exposure to all atmospheric conditions and atmospheric contaminants
 - sheltered exposure, i.e. exposure with protection from atmospheric precipitation and solar radiation either under a cover or in a partly closed space, such as shutter sheds, where the test specimens are also protected by shuttered side walls.
- Due to the possibility of carrying out sheltered exposure in different ways, it is essential that comprehensive details of the shelter and the manner of exposing specimens are given. The results obtained under different shelters cannot be readily compared.

Test site requirements

- The presence of buildings, structures, trees and certain geographical features, rivers, lakes, hills or hollows may cause unintended shelter or exposure to wind, sources of pollution or sunlight
- the presence of low growing shrubs and other plants may affect the temperature and humidity distribution over a given test site and therefore these should be absent or controlled to a maximum height of 0,2 m or by placing test frames on well drained ground or on gravel, concrete or paved foundations
- If chemicals are used to control plant growth in the vicinity of the specimen racks, care shall be exercised to keep such chemicals from coming into contact with any of the specimens and safety precautions shall be taken

Test site locations

- The location of the test site shall permit periodic observations of the test specimens and recording or evaluation of the environmental factors.
- It is advantageous to locate atmospheric exposure test stations near to or at a meteorological station.
- The location of the test site should be selected both from the point of view of the environment as well as ease of examination.

Site security

- Atmospheric corrosion test sites shall be designed to provide adequate security against theft, damage or other forms of interference.
- Care should be taken that security fencing does not affect the testing, for example by causing some specimens to be in shadow more than others or buried by snow drifts

Exposure frames

- Metal sections or wood may be used
- The structural components of the frame shall not shelter the specimens
- The method of attaching specimens to the test frame shall prevent neighbouring specimens from touching, sheltering or influencing one another and shall also provide complete electrical insulation between the specimens and the test frame
- The test frames shall also be designed to enable specimens to be exposed at an angle of 45' from horizontal (30' are permissible) skyward facing, or in other orientations required by the test programme
- This minimum height shall be chosen to prevent both splashing by rainwater and burial in snowdrifts and should be not less than 0,75 m.
- Frames shall be firmly anchored to the ground and specimens shall not move or become detached in high winds.

Test duration

- The total period and the season of exposure depend on the type of test specimen and the purpose of the test. Due to the relatively slow rate of the atmospheric corrosion process, it is recommended that test exposures be on a schedule such as 1 year, 2 years, 5 years, 10 years or 20 years depending, on the corrosion resistance of the metal or coating being tested.
- It should be noted that, especially for short term testing, the results might depend on the season when exposure is initiated. Therefore, it is recommended that exposures are commenced in the period of highest corrosivity (usually autumn or spring).

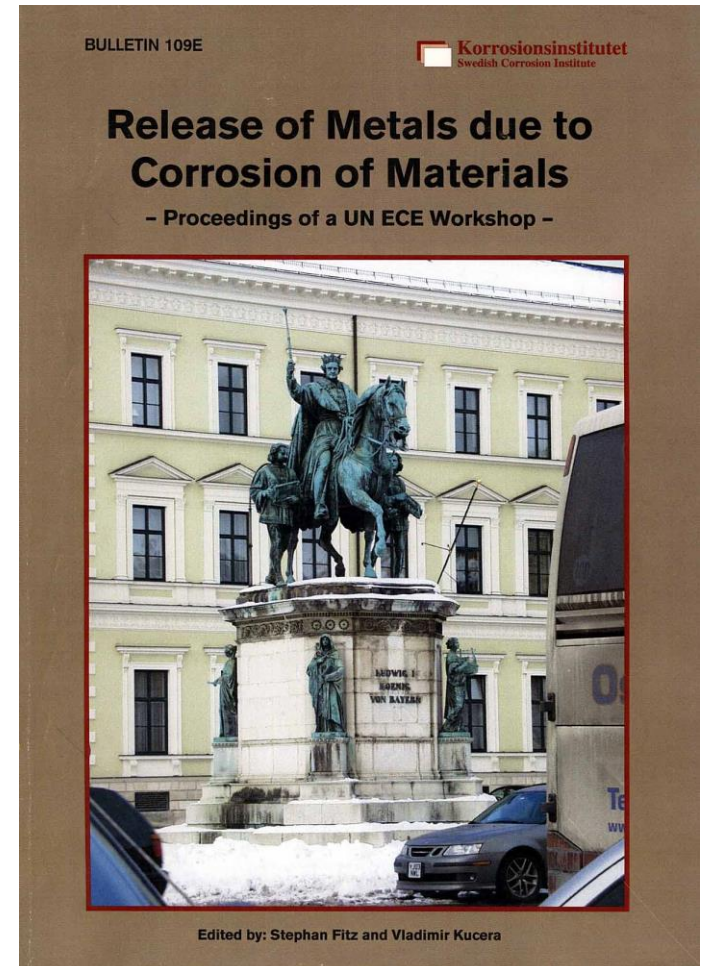
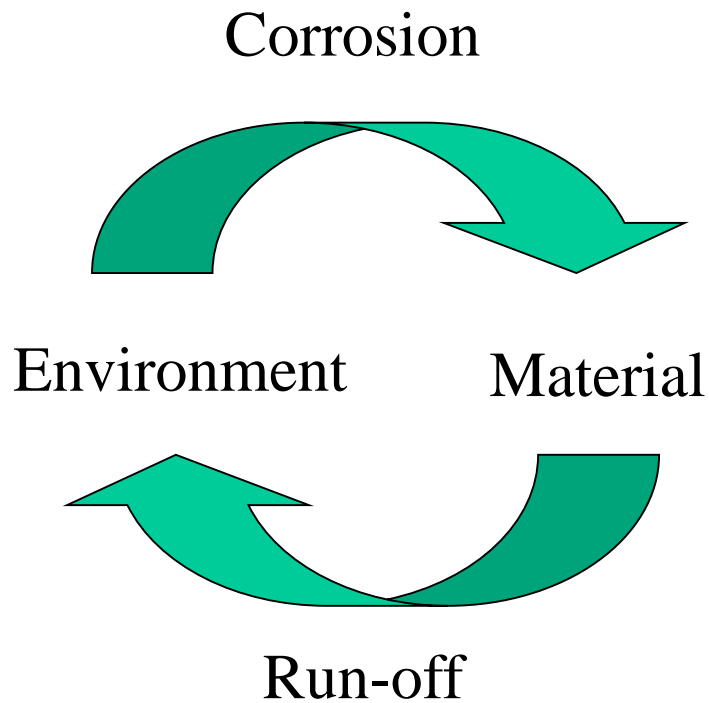
Monitoring (minimum requirements)

- Air temperature
- Relative humidity
- Precipitation
- SO₂ concentration or deposition rate
- NO₂ concentration
- O₃ concentration of
- Chloride deposition rate

New ISO standard for measuring run-off

Corrosion impacts on the environment

Munich, Germany, May 12-14, 2003

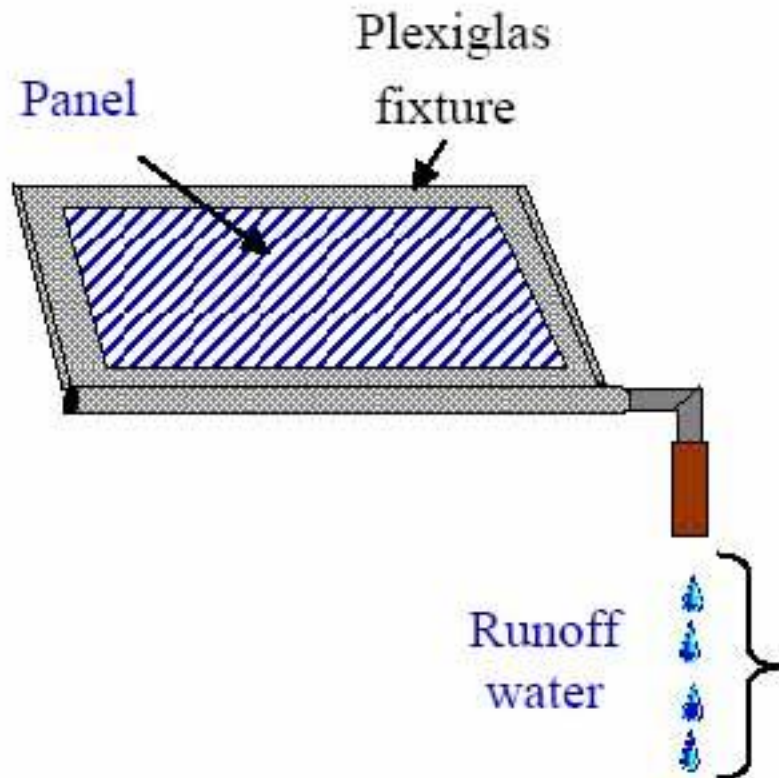




Why such interest for metal runoff?

- Restricted and regulated use of certain metals within EU.
- Regulations based on caution, not on full environmental risk assessment
- Environmental risk assessment requires information, not yet available.
- New gaps of knowledge identified, e.g. the metal runoff and its environmental effects.

Field exposures.



Cr, Ni and Fe analysis in runoff water through:

Atomic Absorption with
graphite furnace
Induced Coupled Plasma
Mass Spectroscopy

Chemical speciation
modelling