

## Different Types of Corrosion

- Recognition, Mechanisms & Prevention

### Uniform Corrosion (General Corrosion)

#### Recognition

**What is uniform corrosion?** Uniform corrosion or general corrosion, as sometimes called, is defined as a type of corrosion attack (deterioration) that is more or less uniformly distributed over the entire exposed surface of a metal (see illustration below). Uniform corrosion also refers to the corrosion that proceeds at approximately the same rate over the exposed metal surface.

Cast irons and steels corrode uniformly when exposed to open atmospheres, soils and natural waters, leading to the rusty appearance.

The photo on the right showed uniform corrosion (rusting) of a pair of steel nuts used to fasten a galvanized steel clamp on a street lamp post. In sharp contrast, the galvanized steel clamp did not show any signs of corrosion but its surface was discolored by the rust. It is also interesting to note that the surface of the top bolt looked like galvanized but the surface of the bolt below was completely rusted (just like the nut).

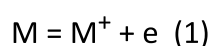


The photo (above, left) shows a steel coupon corroded (rusted) uniformly over its entire surface after immersion in oxygen aerated water while the same batch of coupons exposed to deaerated water (above, right) retained their metallic appearance with no visible corrosion (rust).

In natural environment, oxygen is the primary cause of uniform corrosion of steels and other metals and alloys.

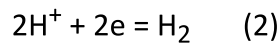
#### Mechanisms

**What causes uniform corrosion?** The anodic reaction in the corrosion process is always the oxidation reaction:

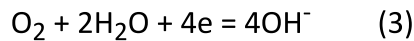


In acidic environments, i.e.,  $\text{pH} < 7$ , the cathodic process is mainly the reduction of hydrogen ions:





In alkaline or neutral environment, i.e., pH=7 or pH>7, reduction of dissolved oxygen is the predominant cathodic process that causes uniform corrosion:



With uniform distribution of cathodic reactants over the entire exposed metal surface, reactions (2) and/or (3) take place in a "uniform" manner and there is no preferential site or location for cathodic or anodic reaction. The cathodes and anodes are located randomly and alternating with time. The end result is a more or less uniform loss of dimension.

## Corrosion Prevention

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**How to prevent uniform corrosion?** Uniform corrosion or general corrosion can be prevented through a number of methods:

- Use thicker materials for corrosion allowance
- Use paints or metallic coatings such as plating, galvanizing or anodizing
- Use Corrosion inhibitors or modifying the environment
- Cathodic protection (Sacrificial Anode or Impressed Current -ICCP) and Anodic Protection

## Corrosion Modeling and Corrosion Prediction Software

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General corrosion can be predicted using corrosion modelling software such as the following:

- **CO2Compass:** CO2/H2S/S Corrosion Modeling, Prediction, Assessment and Solutions
- **PipelineCompass:** Your Guide to Pipeline Corrosion Modeling, Prediction, Assessment and Solutions
- **CP-Compass:** Cathodic Protection Design, Verification, Assessment and Solutions
- **CRA-Compass:** Your Guide to Corrosion Resistant Alloys (CRA)-Corrosion Prediction, Selection and Application Limits
- **FAC-Compass:** Erosion Corrosion and Flow-Accelerated Corrosion Modeling, Prediction, and Materials Selection in Water-Steam Systems

## For more details on uniform corrosion

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More details on Uniform Corrosion or General Corrosion are included in the following corrosion courses which you can take as in-house training courses, course-on-demand, online courses or distance learning courses:

- Corrosion Control and Its Prevention (5 days)
- Corrosion Inspection, Testing and Monitoring: Techniques and Applications (5 days)
- Corrosion, Metallurgy, Failure Analysis and Prevention (5 days)
- Marine Corrosion, Causes and Prevention (2 days)
- Materials Selection and Corrosion (5 days)
- Stainless Steels and Alloys: Why They Resist Corrosion and How They Fail (2 days)

If you require corrosion expert witness or corrosion consulting service on uniform corrosion, our NACE certified Corrosion Specialist is able to help. Contact us for a quote.

