

# Classification of Corrosion

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## 1. General (Uniform) Corrosion

- Uniform thinning over the exposed surface
  - Spread of corrosion over the entire surface by
  - Constant shift of anodic and cathodic sites
- Estimation of life expectancy with reasonable accuracy

## 2. Localized Corrosion

### ○ Galvanic corrosion

- Two dissimilar metals in contact in the presence of an electrolyte

### ○ Pitting

- Definition: Cavity diameter at the metal surface is of the order of the cavity depth
- Fixed anodic and cathodic site initiated by
  - surface defects
  - emerging dislocations
  - incomplete surface films/coatings
- Propagation by auto-catalytic mechanism
  - Buildup of acidic metal chlorides in a pit by
  - Positively charged anodes that attract negative chloride ions
  - Progressive increase of penetration rate with time

### ○ Crevice corrosion

- Special type of pitting with the geometry of crevice
- Wide enough to permit entry of the liquid, but narrow enough to maintain a stagnant zone
- Anode of a corrosion cell in a crevice or under a deposit
- Metals with oxide films or passive layers for corrosion resistance is susceptible

### ○ Selective leaching (Parting, De-alloying)

- Example: de-zincification of brasses, de-nickelification of cupro-nickels
  - Porous copper structure is left behind
- Occurs in a plug form or in a more evenly distributed layer type

### ○ Erosion and erosion-corrosion

- Acceleration of metal loss (mechanical wear) due to the relative movement between a fluid and a metal surface
- Removal of passive surface film for corrosion resistance
- Cavitation
  - Caused by collapse of vapor bubbles in liquid contacting a metal surface
- Fretting corrosion

### ○ Intergranular corrosion

- Selective attack of grain boundary

## 3. Cracking

### ○ Corrosion fatigue

- Simultaneous action of corrosion and cyclic stresses
- Combined effect much greater than the effect of either one alone
- Initiated at surface defects, pits, or irregularities
- Transgranular propagation

- Wedge-shaped profile: width depends on the stress frequency
    - Fine cracks result from high-frequency stresses
    - Broad cracks result from low-frequency stresses
  - **Stress corrosion cracking**
    - Combined action of static tensile stress and corrosion
  - **Hydrogen damage**
    - Diffusion of atomic hydrogen into the metal collected at internal voids or laminations to form more voluminous molecular hydrogen.
- 4. Exfoliation**
- Leaves metals in a laminated, flaky, or blistered condition
  - Aluminum alloys and cupro-nickels are susceptible
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