Classification of Corrosion

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