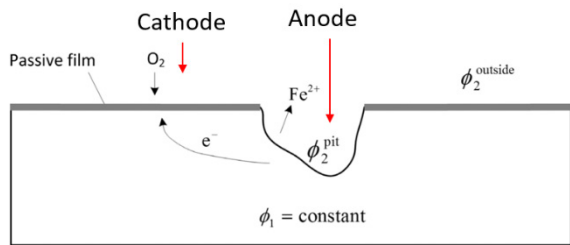


## In class work w8d1

- (1) Considering what you know about Pourbaix diagrams and the balanced chemical reactions at the anode and cathode, explain how pH and/or differences in pH can lead to localized corrosion as illustrated in the image from the lecture below?

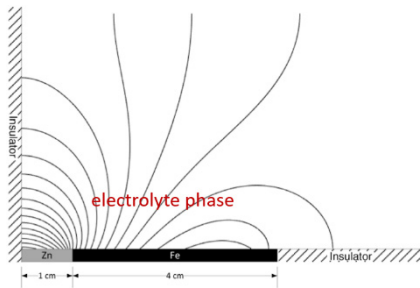


- (2) Consider the following from the lecture notes. Explain why if you took a very small Ag/AgCl reference electrode and placed it inside the pit while corrosion was taking place and then placed another identical reference electrode outside the bit but in the same electrolyte you would measure a non-zero voltage.

- *Is the potential measured inside the pit (w/ a very small reference electrode) greater or less than that measured with the same ref electrode outside of the pit?*
  - $\phi_{\text{metal}}$  is the same at both locations as metal highly conductive
  - $\phi_{\text{ref,pit}} > \phi_{\text{ref,outside}}$  (why does reference electrode shift?)
  - measured potential of metal versus reference inside pit is less than outside the pit

(3) Consider the images below from the book showing the electric field lines in the electrolyte phase of a piece of metal undergoing galvanic corrosion (left), the effect solution conductivity on the local currents (middle and right).

- What is the integrated faradaic current density crossing the metal/electrolyte interface.
- Why is the dissolution rate of iron lower when coupled with zinc?
- What role does the size of the electrodes play?
- Are differences in the kinetics of the cathodic reactions on the two metal surfaces important? Would higher cathodic reaction rates on iron make the zinc corrosion better or worse?
- Why is the dissolution rate of iron lower when coupled with zinc?
- Why is the iron dissolution rate higher for the lower conductivity solution?
- Why are the local corrosion rates non-uniform when the metals are coupled?
- Do any cathodic reactions take place on the zinc electrode?
- What roles do the equilibrium potentials for zinc and iron play?
- How would stirring affect the galvanic corrosion rates?



- $\text{Zn}^{2+}$  being made at Zn electrode (Tafel)
- $\text{H}^+$  being consumed at Fe electrode by ORR (Tafel) or HER
- Shortest path for ions to travel is at junction of the two metals.

