Long-term effects on passive film dissolution and localized corrosion

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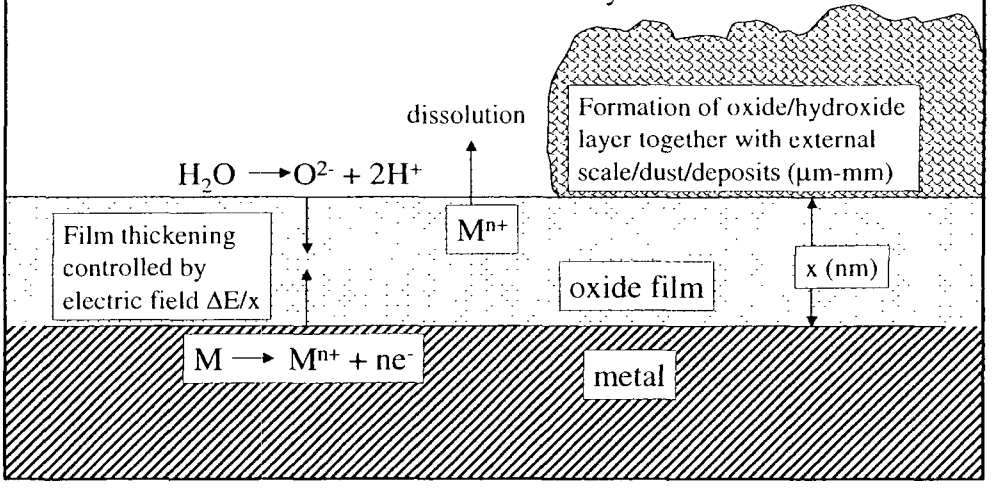
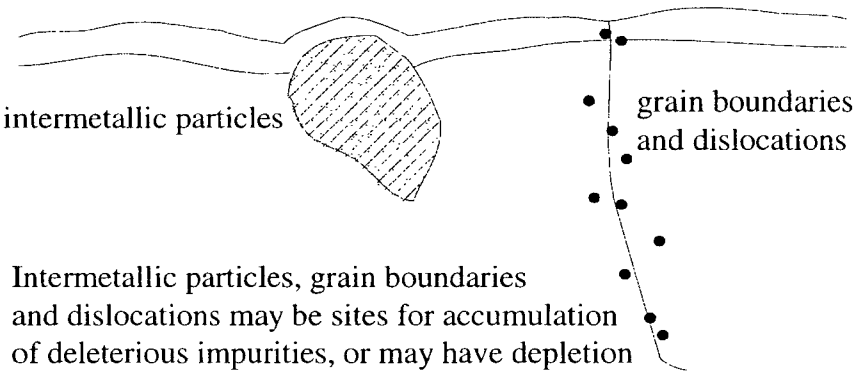
Formation and dissolution of passive films in aqueous environments

At long times, dissolution is the rate-limiting step: the film thickness reaches a steady state value



Dissolution will be greatest at heterogeneities in the surface



Intermetallic particles, grain boundaries and dislocations may be sites for accumulation of deleterious impurities, or may have depletion of beneficial elements

Factors that could increase dissolution of passive films

- Impurities in the alloy, e.g. S, P - *segregation to grain boundaries or dislocations over long times, perhaps enhanced by irradiation?*
- Intermetallic phases or solute-depleted regions in the alloy with higher dissolution rate - *formation over long times?*
- Transpassive dissolution - *requires elevated potential - catalytic deposits, radiolysis, microbial effects?*
- Impurities from the environment, e.g. S species

Factors affecting localized corrosion

- similar to effects on passive current density
  - *open circuit potential increase*
  - *segregation of impurities, formation of intermetallics, depletion of beneficial elements*
- additionally...effect of deposits
  - *crevice-like behavior under deposits*
  - *ion-selective action of deposits*