Modelling and simulation of micro-galvanic corrosion of Al alloys induced by IMPs
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Abstract: FEM model provides a powerful method for corrosion investigation of Al alloys by taking into account the complicate homogeneous reactions, mass transport, kinetic moving boundary, as well as the deposition and blocking effect of Al(OH)₃.

Model development

Results and conclusions

 próblem shows possibility for Al(OH)₃ depositing, block effect of deposited Al(OH)₃, leads to a much slower and shorter corrosion process.

Rᵥ effect: Small Rᵥ (pit mouth) limits inward mass transport of OH⁻, leading to localized acidification inside the dissolution volume, in turn inhibiting deposition of Al(OH)₃, a self-catalysis process occurs.

Rᵥ effect: Large IMPs support more cathodic O₂ reduction, provides larger galvanic current, but also a faster passivation.

Conclusions:
- The developed FEM model provides a deeper insight into the relationship between microstructure and micro-galvanic corrosion of Al alloys.
- Using a coverage parameter, the deposition of Al(OH)₃ and subsequent blocking effect on surface reactions can be described quantitatively and kinetically.
- The blocking effect leads to a reduced local corrosion rate, and eventually to a static corrosion frontier corresponding to a completely blocked active surface.
- Decrease of Rᵥ enahces local acidification inside corroding volume resulting from the limited mass transport of OH⁻ ions into the volume, furthermore, this would slow down the deposition of Al(OH)₃ leading to pits stabilization and propagation.
- Smaller IMP with Rᵥ = 0.5 and 1 µm can provide enough drive force for active dissolution.

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