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NUMERICAL MODELING OF ELECTROSTATICS IN ALKALYNE ELECTROLYZERS WITH CONTACT TYPE BOUNDARY CONDITIONS

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Abstract.

Alkaline electrolyzers (AEL) split water molecules into hydrogen and oxygen using an alkaline solution like potassium hydroxide (KOH) as an electrolyte. They have two electrodes, an anode and a cathode, separated by a diaphragm or membrane. Numerical simulation of AELs involves multiphase flow in the electrolyte and electrostatics plus thermal in the whole region composed of electrolyte, electrodes, and membrane. The electrostatics are governed by the Poisson equation, but the boundary condition on the electrode surface is complex. It involves a unilateral restriction, similar to a contact-type boundary condition in mechanics. The interface does not conduct electricity until a certain threshold potential difference is reached. This condition can be solved numerically as a unilateral restriction using penalization or Augmented Lagrangians.

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