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ELECTRO-KINETIC STRUCTURE MODELS WITH INTERFACIAL REACTIONS

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Summary: In the framework of fundamentals of smart materials and structures, a proper mathematical modeling of electro-kinetic transport phenomena in micro-structures adhering to the law of conservation of mass is suggested. The reference multiphase medium is described by a nonlinear Poisson-Nernst-Planck model stated in a heterogeneous pore-particle space disjoint by the interface. For physical consistency it allows nonlinear boundary reactions at the phase interface. Based on suitable entropy variables, a variational principle is established within the Gibbs simplex preserving a volume balance and positive concentrations. The resulting generalized model is provided by rigorous analysis and supported by homogenization of stationary states.