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Development of Pore Network Model for Capacitive Deionization

Capacitive deionization (CDI) is a novel technology useful for desalination of brackish or low salinity water systems. It's high energy efficiency in such waters makes it an attractive alternative to more conventional reverse osmosis. A CDI cell is comprised of a pair of oppositely charged electrodes where ions from water are stored in electrical double layers. Much research has already been invested into the performance of such electrodes for the adsorption, storage, and desorption of ions. Many different models have been developed to better understand the theory behind capacitive deionization and to develop optimal CDI systems. There are many volume averaging models available in literature but no pore scale model (to the best of our knowledge) has been developed for CDI. Capacitive deionization is a complicated system as it consists of several transportprocesses: advection, diffusion, migration, and saturation kinetics. Pore network models offer much better understanding of the impact of porous structure on transport processes compared to commonly used volume averaged models. In this research, the development of a pore network model for capacitive deionization is explored.