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Ion Transport in Electric Double Layer Capacitors for Water Desalination[1] BATYA FELLMAN, EVELYN WANG, Massachusetts Institute of Technology — Capacitive deionization is a promising method for efficient water desalination. In this approach, salt water is passed through two polarized electrodes, whereby the salt absorbs onto the electrode surface for removal. We investigated high surface area carbon-based electrode materials, including activated carbon and activated carbon cloth, for capacitive deionization. In a 1 M NaCl electrolyte, the activated carbon cloths with a surface area of 1000-2000 m^2/g exhibited specific capacitance values of approximately 40 F/g, which is an order of magnitude lower than that of state-of-the-art aqueous capacitors. We speculate that the discrepancy is related to transport limitations at the electrode-electrolyte interface. Based on these studies, we fabricated new controlled electrode geometries and surface chemistries to enable detailed studies of ion transport in the electric double layer and to understand the effect on charging times and specific capacitance. Experimental techniques, including cyclic voltammetry, chronocoulometry, and impedance spectroscopy, were used. These studies help elucidate transport mechanisms and provide insight into optimal design for effective capacitive deionization.

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