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Microscale Electrodeionization: in situ Concentration Profiling and Flow Visualization[1] SUDONG PARK, RHOKYUN KWAK, Hanyang University, Korea — Electrodeionization (EDI) is a membrane-based desalination system utilizing ion exchange membranes and resins. By combining electrodialysis and ion exchanger, EDI can produce ultrapure water in continuous-flow manner. Although its theoretical mechanisms are well documented, there is no experimental platform which can provide microscopic details inside the system. In this paper, we present microscale EDI that visualizes in situ ion concentration, pH, and fluid flow. The platform was fabricated by filling ion exchange resins as a monolayer in a transparent polydimethylsiloxane channel between cation/anion exchange membranes. According to operating voltages (0-15V), distinct behaviors of ion concentration profile, pH shift, and fluid flow were observed in ohmic, limiting, and overlimiting regimes. It is noteworthy that overlimiting regimes can be sub-categorized as water-splitting regime and electroconvection regime. In early stage (4-6V), water-splitting is dominant with pH change near the membranes and resins; under higher voltage (8-15V), electroconvection start to occur even water-splitting tries to suppress the development of the electroconvective instability on the resins.

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