Contribution ID: **562** Type: **Oral Presentation**

Enhanced Mixing in Porous Media Through Electroosmotic Flow

Monday 19 May 2025 14:05 (15 minutes)

Mixing in porous media and microfluidic devices can play a crucial role in various processes, including in-situ mining of minerals, geothermal heat extraction, and efficient operation of microreactors. However, such environments typically support flow at low Reynold's numbers, so achieving controllable mixing can be challenging. To address this, electric fields can offer an externally adjustable way to enhance mixing through electrokinetic flow. We explore the interaction between electroosmotic and pressure-driven flows in heterogeneous porous media through experiments using Hele-Shaw cells. Specifically, we focus on the relationship between cell heterogeneity, flow recirculation, and mixing. When a charged surface comes into contact with an electrolyte solution, a diffuse layer of counter-ions forms, creating the electric double layer that screens the surface charge. Applying an external electric field parallel to the solid surface induces electroosmotic flow via an effective slip at the solid surface. In regions of high permeability, pressure-driven flow dominates, whereas, in narrow spaces, electroosmotic flow prevails, leading to recirculating flows between high- and low-permeability zones. By harnessing the interaction between these two flow mechanisms, we characterize electroosmotic mixing in porous media.

Country

United States

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Water & Porous Media Focused Abstracts

References

Author: SHAMSI, Zahra

Co-authors: PAHLAVAN, Amir (Yale University); PRIMKULOV, Bauyrzhan (MIT)

Presenter: SHAMSI, Zahra

Session Classification: MS08

Track Classification: (MS08) Mixing, dispersion and reaction processes across scales in heterogeneous and fractured media