

# Coupling pH Transport and Surface Chemistry

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Transport of pH through reactive media gives rise to reaction fronts with complex morphologies. The first-order structure of these fronts can be analyzed in the hyperbolic limit of the governing equations. Results from column flow experiments through silica glass beads and quartz sand show agreement with analytical simulations. Results highlight the effect of nonlinear sorption on transport behavior. We evaluate the ability of various surface chemistry models to predict experimental breakthrough behavior. Incorporation of electrostatic forces in sorption improves model predictions over Langmuir type assumptions. In comparison to experimentally derived sorption relationships, a significant discrepancy in predicted behavior is observed. This discrepancy is attributed to the influence of transport conditions on the sorption behavior of protons. A classical interpretation would contribute this effect to chemical kinetics. We present evidence suggesting the phenomenon is due to streaming current influencing the electrochemistry of the grain surface. Our findings suggest that sorption relationships obtained from batch titration experiments may not be appropriate for predicting transport behavior in ionic species which are highly sensitive to surface charge.