# Effective models for nonlinear drift-diffusion of multiple species in porous media

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We consider a nonlinear drift-diffusion system for multiple charged species in a porous medium in 2D and 3D with periodic microstructure. The system consists of a transport equation for the concentration of the species and Poisson's equation for the electric potential. The diffusion terms depend nonlinearly on the concentrations. We consider non-homogeneous Neumann boundary condition for the electric potential. The aim is the rigorous derivation of an effective (homogenized) model in the limit when the scale parameter $\epsilon$ tends to zero. This is based on uniform *a priori* estimates for the solutions of the microscopic model. The crucial result is the uniform $L^\infty$-estimate for the concentration in space and time. This result exploits the fact that the system admits a nonnegative energy functional which decreases in time along the solutions of the system. By using weak and strong (two-scale) convergence properties of the microscopic solutions, effective models are derived in the limit $\epsilon \to 0$ for different scalings of the microscopic model. This is a joint work with Apratim Bhattacharya (Erlangen) and Markus Gahn (Heidelberg).