Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Study of a chain reaction in electrokinetic fluids with the Lattice Boltzmann Method[1] HAIJING LI, FEDERICO TOSCHI, HERMAN CLERCX, Eindhoven Univ of Tech, FLUIDS FLOWS TEAM — A 2D model is developed for a reactive electro-kinetic fluid in porous media based on the Lattice Boltzmann Method (LBM). The momentum, concentration and electric fields are simulated via the Navier-Stokes, advection-diffusion/Nernst-Planck and Poisson equations, respectively. With this model, the density, velocity, concentration and electric fields, and the interaction between the fields can be studied, which allows us to get an insight into the interplay between the chemistry, flow and geometry of the porous medium. In this work, two types of reactions are studied, namely, surface reactions and electric breakdown reactions. The results show that the conversion efficiency of both reactions can be strongly influenced by the flow and reaction parameters such as the fluid velocity, reactant concentration and the porosity of the porous media, which makes the reaction conversion efficiency display a non-trivial and non-monotonic behaviour as a function of the flow and reaction parameters. An analytical model of the chain reaction consisting of both reactions will be further studied. Using this model, one may be able to optimize the choice of the flow and reaction parameters in order to improve the performance of the reactions and achieve higher production rates.

[1]This project is funded by the China Scholarship Council (CSC)

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Date submitted: 27 Jul 2020 Electronic form version 1.4