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Effective reaction rates for transport of particles to heterogeneous reactive (or porous) surfaces under shear. PREYAS SHAH, ERIC S. G. SHAQFEH, Stanford Univ — Mass transfer to heterogeneous reactive (or porous) surfaces is common in applications like heterogeneous catalysis, and biological porous media transport like drug delivery. This is modeled as advection-diffusion in a shear flow to an inert surface with first order reactive patches. We study transport of point particles using boundary element simulations. We show that the heterogeneous surface can be replaced with a uniform-flux boundary condition related to the Sherwood number (S), aka, the dimensionless flux to the reactive region. In the dilute limit of reactive regions, large-scale interaction between the reactive patches is important. In the dilute limit of inert regions, [S] grows as the reciprocal of the inert area fraction. Based on the method of resistances and numerical results, we provide correlations for [S] for general reactive surfaces and flow conditions. We model finite sized particles as general spheroids, specifically for biological applications. We do Brownian Dynamics simulations to account for hydrodynamic and steric interactions with the flow field and the domain geometry, and compare to the point particle results. We observe that anisotropic particles gave a higher pore transport flux compared to spherical particles at all flow conditions.

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