Simulation of the Dynamics of Particles in Fluids Through a Narrow Channel

Martinez, Sophia (School: Petra Mercado Bougart)

Micrometer size carbon separation plays a critical role in chemical and biological applications for instance, drug delivery (Yao et al., 2024) . For example, size uniformity is crucial for optimal apparatus performance of spherical carbon spheres when used in a range of applications, including energy storage. Physical filters are often used to select spheres in a limited size range, but they tend to clog. This work studies the separation by size of spheres by a microfluidics method called Pinched Flow Fractionation. What happens inside a real apparatus is impossible to see without the use of sophisticated and expensive techniques and instrumentation, so we simulated it. Six simulations where a single sphere was placed in a solvent in a simulated channel, one layer of solvent and one layer of buffer, were performed for spheres with diameters ranging from 25μm to 150μm. Results show that the spheres move from solvent to buffer different distances according to their size. Moreover, the moment at which the spheres reached maximum movement from solvent to buffer varied on size. Thus, we proposed a variation of the apparatus design, which could more optimally separate the spheres. This could enable the creation of more efficient devices by being able to store more energy in the same space.

Awards Won: