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GPU-enabled Computational Model of Electrochemical Energy Storage Systems CHARLES ANDERSEN, GANG QIU, NAGARAJAN KANDASAMY, YING SUN, Drexel University — We present a computational model of a Redox Flow Battery (RFB), which uses real pore-scale fiber geometry obtained through X-ray computed tomography (XCT). Our pore-scale approach is in contrast to the more common volume-averaged model, which considers the domain as a homogenous medium of uniform porosity. We apply a finite volume method to solve the coupled species and charge transport equations. The flow field in our system is evaluated using the Lattice Boltzmann method (LBM). To resolve the governing equations at the pore-scale of carbon fibers, which are on the order of tens of microns, is a highly computationally expensive task. To overcome this challenge, in lieu of traditional implementation with Message Passing Interface (MPI), we employ the use of Graphics Processing Units (GPUs) as a means of parallelization. The Butler-Volmer equation provides a coupling between the species and charge equations on the fiber surface. Scalability of the GPU implementation is examined along with the effects of fiber geometry, porosity, and flow rate on battery performance.

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