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Dispersion properties in porous media: application to Redox Flow Battery electrodes FRANCESCO PICANO, DARIO MAGGIOLO, ANDREA MARION, MASSIMO GUARNIERI, Department of Industrial Engineering, University of Padova — Redox Flow Batteries (RFBs) represent a promising technology as a way to store energy. However, in order to improve RFBs performance, some conceptual and technological issues are still open. In particular, a properly designed geometry of flow channels and porous medium is still under investigation in order to uniformly distribute the reacting species all along the electrode. The ideal configuration aims to minimize the drag maximizing the mixing so to increase the overall performance and efficiency. In the present work a Lattice Boltzmann 3D model (LBM) has been used to better understand the dependence of mass and momentum transports on the porosity and carbon fiber preferential orientation. The LBM has been coupled with a Lagrangian particle tracking algorithm in order to investigate the dispersion mechanisms induced by the porous medium on the species flowing in a typical RFB. Results show that the drag is considerably reduced when the medium fibers are preferentially oriented along the streamwise direction. Surprisingly, this configuration shows also the highest transversal dispersion rate characterized by a super-diffusive behavior. Actually, the dispersion features are found to strongly depend on the porous media microstructure showing either anomalous or regular diffusion.

Francesco Picano
Department of Industrial Engineering, University of Padova

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