Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Gas exchange in an interfacially-driven bioreactor SHANNON GRIFFIN, JOE ADAM, PATRICK MCMACKIN, FRANK RILEY, AMIR HIRSA, Rensselaer Polytechnic Institute — Gas transfer at interfaces is a limiting factor in the performance of many chemical reactors and bioreactors. The knife-edge surface viscometer (KEV) is a fluid physics apparatus in which a thin, rotating ring at the interface of a liquid conveys shear and mixing to the bulk fluid via surface shear viscosity and secondary inertial flow. KEVs can function as chemical reactors or bioreactors driven by prescribed interfacial shear rates. This investigation focuses on the effects of interfacial shear on gas transfer using a KEV. Simulations using COMSOL were compared to CO_2 gas transfer experiments with varying Reynolds (Re) and Boussinesq (Bq) numbers. Results show a monotonic increase in gas transfer with increasing Re and increasing Bq, as measured by the time required to reach steady-state gas concentration in the KEV. These results are relevant to applications and future studies in chemical reactors, bioreactors, and gas transfer in microgravity studied using the ring-sheared drop (RSD). A containerless bioreactor launched to the ISS in 2019, the RSD was originally designed to study amyloid fibrillization without interaction with solid walls.

Shannon Griffin
Rensselaer Polytechnic Institute

Date submitted: 10 Aug 2020 Electronic form version 1.4