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High Speed motion generated by an oscillating microfiber QI (RICK) HE, BIAN QIAN, Brown University, SHANE WOODY, BETHANY WOODY, Insitutec, KENNETH BREUER, Brown University — We present detail regarding the flow field generated by the high-speed motion of a long, thin elastic fiber immersed in a viscous fluid. The fiber, made of glass, or carbon, is approximately 1 mm in length, has a diameter of 7 microns, and is immersed in water, seeded with sub-micron tracer particles. The fiber is oscillated back and forth at 32 kHz with a peak-to-peak tip amplitude of approximately 10 microns. The resultant flow field is measured using micro-PIV, imaged at high speed using an intensified high speed camera, capable of taking data up to 12kHz. Symmetric vortices around the tip are generated by the steady streaming effect, with fluid velocities approaching 1 m/s, and shear rates close to 10^5 s^{-1}. The vortices have a strong three-dimensional structure due to the presence of the substrate below the moving tip, as well as the axial variation of the fiber amplitude. In addition to quantifying the fluid motion, the mixing of fluid and the dispersion, and accumulation of particles due to the fiber motion is measured and discussed.

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