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Anisotropic particles in highly turbulent Taylor-Couette flow¹ DENNIS BAKHUIS, RUBEN A. VERSCHOOF, VARGHESE MATHAI, Univ of Twente, SANDER G. HUISMAN, ENS de Lyon, DETLEF LOHSE, Univ of Twente, CHAO SUN, Tsinghua University — In industry and nature, particle-laden turbulent flows consist mostly, if not always, of anisotropic particles. Examples of such flows are plankton distributions in the oceans, and pumping of concrete. In these flows, the suspended particles often distribute inhomogeneously, thereby affecting the drag and the flow properties significantly. Despite their widespread occurrence, a good understanding of how such particles affect the flow is still missing. Here we performed Particle Tracking Velocimetry and global torque measurements for a suspension of rigid fibers (or rods) in the Twente Turbulent Taylor-Couette facility. The fibers are density matched with the fluid, and we used particle volume fractions up to $\alpha = 2\%$ of fibers with aspect ratio $\lambda = L/d = 5$, where L = 5 mm is the length and d = 1 mm the diameter. The global torque measurements were performed for Reynolds numbers up to 2.5×10^5 and showed similar values of drag reduction as was obtained for spherical particles ($\lambda = 1$). Using PTV we have extracted the orientation, the rotation rate, and the translation velocity and acceleration for the fibers. The fibers do not show a clear alignment with the main velocity gradient. We do, however, observe occasional large rotation rates for the fibers.

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