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Numerical simulation of two-phase turbulent Taylor-Couette flow with finite-size drops/bubbles ROBERTO VERZICCO, Uniroma2, DETLEF LOHSE, VAMSI SPANDAN, UTwente — Deformable bubbles/drops larger than the Kolmogorov scale (finite-size) dispersed in a turbulent flow can alter the global and local flow properties in several ways. They can enhance or reduce the net momentum/heat transport, alter the path of drops/bubbles or even the rheological properties of the fluid mixture. A detailed understanding of these systems is still missing therefore we use direct numerical simulations to study a two-phase turbulent Taylor-Couette (TC) flow to gain further insight into this problem. We solve the Navier-Stokes equations for the carrier fluid and an immersed boundary method for the dispersed phase ($10^3 drops$). The deformation of the dispersed drops is obtained by a multi-physics interaction potential approach tuned for deformation dynamics of any liquid-liquid interface with a given surface tension. Additionally, the drops can collide with each other or against the walls which makes it a fully resolved four-way coupled simulation. Our simulations show that the net drag reduction increases with increasing deformability of bubbles and this is not related to any preferential accumulation. We show that finite-size bubbles block the momentum transfer from the inner to the outer cylinder thus laminarising the bulk and leading to drag reduction.

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