TOROIDAL DROPS IN VISCOUS FLOW

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Toroidal drops are known since the experiments by Plateau (1854) in rotating fluids. Such shapes and other non-spherical configurations have become of interest in various technological areas, and recently also as potential carriers of drugs (Champion et al., 2007) or building blocks for more complex assemblies (Velev et al., 2000). Such geometry is obtained, for example, when a drop, falling free in a viscous fluid, experiences a finite surface deformation which develops into a toroidal form (Kojima et al., 1984; Baumann et al., 1992; Sostarecz & Belmonte 2003).

In this presentation we shall revisit the stable compression of spherical drops in bi-axial viscous extension, within a finite range of the capillary number, Ca, and show that loss of stability can lead to formation of toroidal shapes. We demonstrate numerically that there is a limited range of Ca in which toroidal stationary solutions exist, and that such drops in this flow are inherently unstable (Zabarankin et al., 2013). However, there is a potential of shape stabilization if the drops are comprised of a mild yield stress material.

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