Abstract Submitted for the DFD11 Meeting of The American Physical Society

Destiny of a drop on a fiber: from barrel to clamshell and back¹ BURAK ERAL, J. DE RUITER, R. DE RUITER, J.M. OH, Physics of Complex Fluids Group, University of Twente, C. SEMPREBON, M. BRINKMAN, F. MUGELE, Dynamics of Complex Fluids, Max-Planck-Institute, Gottingen — Drops on cylindrical fibers are a familiar sight, for instance in the form of dew drops on spider webs. They can exist in two competing morphologies, a cylindrically symmetric barrel state completely engulfing the fiber and an asymmetric clamshell state, in which the drop sits on the side of the fiber. Despite their omnipresence and their practical relevance the physical mechanisms governing the stability of the two morphologies remained elusive. Using electrowetting-functionalized fibers we determined of the stability limits of both morphologies as a function of the two relevant control parameters, the contact angle and the liquid volume. While clamshells are found to prevail for large contact angles and small volumes, and barrels prevail for small angles and large volumes, there is also a wide range of intermediate parameter values, for which both morphologies are mechanically stable. Mapping out the energy landscape of the system by numerical minimization of the free energy we find that the barrel state is easily deformed by non-axisymmetric perturbations. From a general perspective, the demonstration of electrowetting-based reversible switching of liquid morphologies on fibers opens up opportunities for designing functional textiles and porous materials.

¹We thank the Chemical Sciences division of the Netherlands Organization for Scientific Research (NWO-CW) for financial support.

> Burak Eral Physics of Complex Fluids Group, University of Twente

Date submitted: 13 Oct 2011

Electronic form version 1.4