Electronic Supplementary Material (ESI) for Soft Matter.

Shape of a sessile drop on a flat surface covered with a liquid film

Martin Tress[1#], Stefan Karpitschka[2#], Periklis Papadopoulos[3], Jacco H. Snoeijer[2], Doris Vollmer[1], Hans-Jürgen Butt[1*]

[1] Max Planck Institute for Polymer Research, Ackermannweg 10, D-55128 Mainz, Germany

[2] Physics of Fluids Group, MESA+ Institute, University of Twente, NL-7500AE Enschede, The Netherlands

[3] Department of Physics, University Ioannina, P.O. Box 1186, GR-45110 Ioannina, Greece

[#] Equal contribution

* Correspondence: butt@mpip-mainz.mpg.de

Supplementary Material

Key in the present investigation is the optical separation of the drop and the surrounding lubricant in the LSCM images. This could be achieved by employing only one type of fluorescent dye, N-(2,6-diisopropylphenyl)-3,4-perylenedicarboxylic acid monoimide (PMI). Since densities of both liquids differ by a factor of ~2 (Tab. 1), the fluorescence of the PMI molecules exhibits clearly different spectra (Fig. S1). Consequently, two detectors of the LSCM are adjusted to collect photons only in spectral ranges where one of the two fluorescence emissions dominates the other one (491-501 nm and 637-800 nm, respectively). Thus, the drop and the lubricant media, i.e the ionic liquid and the hexane, are imaged separately in two different fluorescence channels.

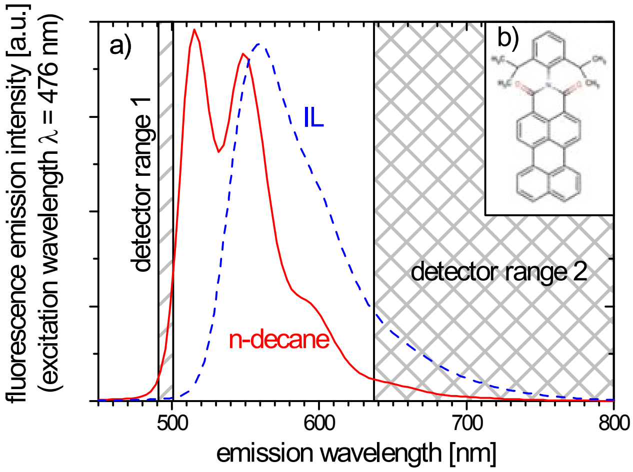

Fig. S1: Fluorescence emission spectra (a) of PMI in n-decane and the ionic liquid EMIM BTF (IL) at an emission wavelength of 476 nm. The shaded boxes indicate the employed wavelength ranges of the two detectors to separate the liquids. Chemical structure of PMI (b).

To deduce the geometrical measures of the drop-on-lubricant system, the two fluorescence channels are processed as follows. In a first step, the contour of the drop and the lubricant cross sections are obtained from the fluorescence images by employing the software FIJI (Fig. S2b). Subsequently, these contours are divided into different sections which can be fit to functions describing their particular geometry. For the drop these are circular arcs for the top and both lateral boundaries to the lubricant as well as a flat boundary to the substrate. To describe these sections with functions, the data of the lateral boundaries are divided into upper and lower parts according to upper and lower half of the circle function. The functional terms of these parts have been combined with the equation describing circular arc of the top and the flat bottom line, respectively, to conjointly fit in each case upper and lower part of the drop. The lubricant on either side is divided into its top surface fit to an exponential, the boundary to the drop (fit to a circular arc again) and a flat bottom line to the substrate (Fig. 2c). Furthermore, the functions contain terms to consider the optical distortion due to differences in the refractive indices of the two liquids and the mismatch with respect to the objective. Mutual points and boundaries of these geometrical functions are fit with shared parameters (Fig. 2d).

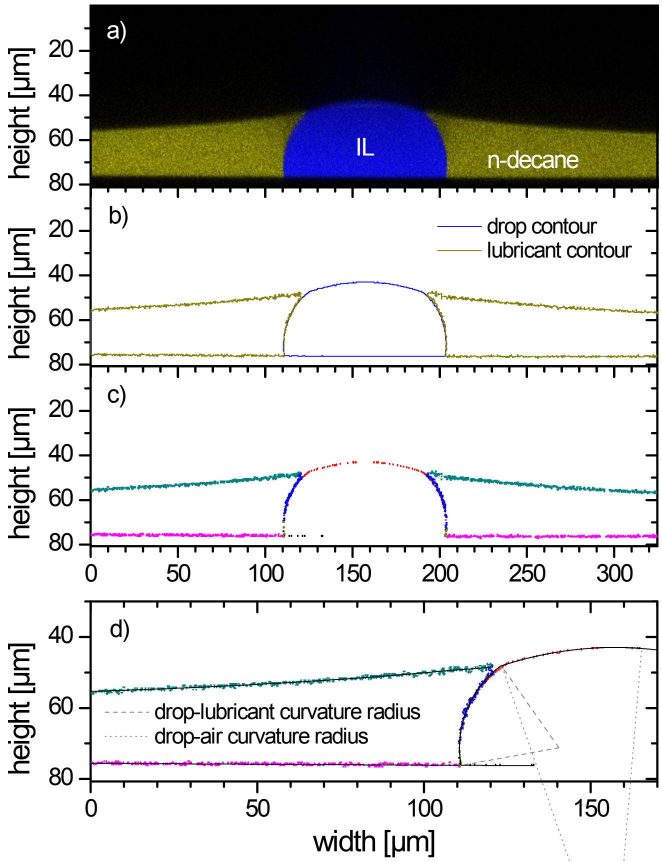

Fig S2: LSCM image of a drop of IL in a n-decane layer (a), the extracted contours (b) and their segmentation in sections (c) to be fit to simple geometrical functions (black squares: bottom half of the drop, red circles: top half of the drop, magenta up-triangles: bottom of lubricant, dark cyan down-triangles: top of lubricant, blue left-triangles: upper circular half of drop-lubricant boundary, dark yellow right-triangles: lower half of drop-lubricant boundary). Enlargement of the left half profile (d) segmented into sections (symbol code is identical to c) and fitted to the multi-function curves. Additionally, the radii of curvature of the drop are indicated.