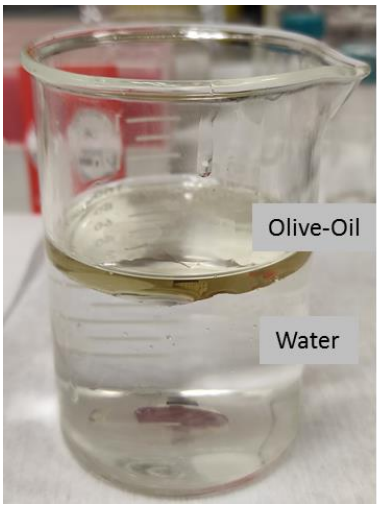
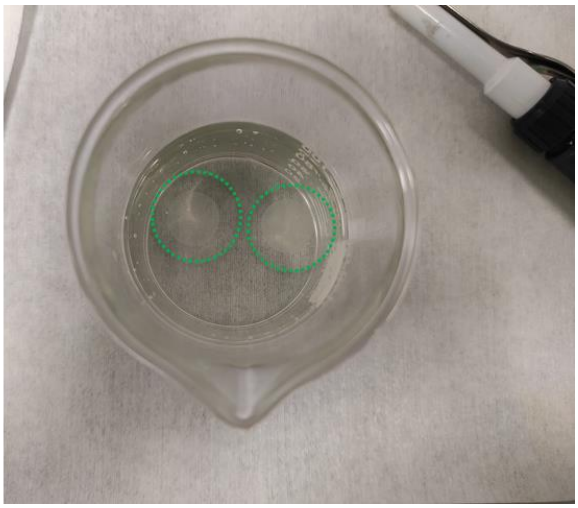
Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information for "Instant in situ formation of a polymer film at the water-oil interface" by S. Coppola et al.

EVO Olive-Oil water configuration

The glass beaker is filled up with tap water (bottom) and with Olive oil (up). Two separate samples were created at the interfaces. The samples are highlighted into green dotted circles in order to help the reader to visualize them in the upper view. The PLGA floating films have been collected using commercial glass slides.





DH setup and Phase retrieval processing

The holographic recording system is set based on an off-axis Mach-Zehnder interferometer, the two laser beams, which emitted from the same He-Ne laser source (Thorlabs, 632.8nm), are used to create the interference fringes on the target screen of CCD camera. As shown in Fig. S1, the laser is enlarged by beam expander structure (BE) before reflected into the Mach-Zehnder interferometric geometry. The first beam splitter prism tube (BS1) is used to divide the single expanded beam into object beam and reference beam, and, the reflected beam is used to record the sample information. The second beam splitter prism tube (BS_2) is used to help the beams converge with certain off-axis angle. The film sample is placed in the front focal plane of lens L_1. Herein, L_1, L_2 and L_3 are set at the certain distances to build a 4F lens multiplexing geometry, which play the role to reduce the imaging field of view (FOV). The focal length of L_1 and L_2 are 150mm, and the focal length of L_3 is 50mm, therefore the imaging magnification of the recording system is 1/3. The CCD camera is set in the back focal plane of L_3, which is XIMEA MD028MU-SY with 1940×1460 pixels of 4.54×4.54 μm^2/pixel.

For the static thickness mapping of membrane, conventional holographic background subtraction thickness measurement **[1]** is applied. In the recording process of digital hologram, the background hologram, which does not contain the object information, is recorded in advance. Then, during the holographic numerical reconstruction processing, the reconstructed background phase information is removed from the static membrane phase mapping. In this case, the thickness of the filmcan be calculated by following formula:

$$h = \frac{\lambda \varphi}{2\pi n}$$

Herein, λ is the holographic recording wavelength, n is the refractive index (RI) of measured sample. Therefore, once the accurate RI of the film is known, the quantitative thickness mapping will be obtained by DH.

[1] Merola F. et al. (2019) Recent Advancements and Perspective About Digital Holography: A Super-Tool in Biomedical and Bioengineering Fields. In: Lamberti L., Lin MT., Furlong C., Sciammarella C., Reu P., Sutton M. (eds) Advancement of Optical Methods & Digital Image Correlation in Experimental Mechanics, Volume 3. Conference Proceedings of the Society for Experimental Mechanics Series. Springer, Cham. https://doi.org/10.1007/978-3-319-97481-1_32