Flat Oil-water Interfaces

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Make a dual surface-treated flow cell. One surface is hydrophilic to promote wetting of the water phase. The other surface is hydrophobic or fluorophilic to promote wetting of the oil phase. Here I use acrylamide for the hydrophilic coating and Aquapel for the fluorophilic. One can use a silane treatment or other for the hydrophobic phase.

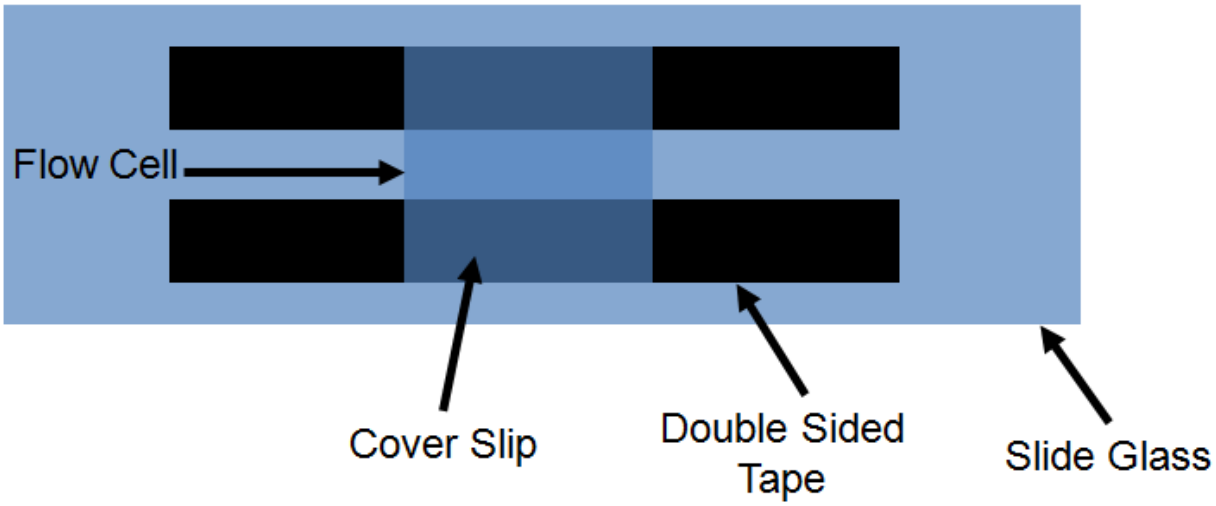
1.) Treat a clean microscope glass slide with Aquapel.

a.) Spread ~100µl of aquapel onto a clean glass microscope slide in the region in which you will make a channel.
b.) To ensure good coverage, you can drop a large (20x40mm) coverslip over the bead of aquapel to spread the aquapel over the surface and prevent it from beading.
c.) Let the aquapel incubate for a few seconds to a minute.
d.) Remove coverslip and use nitrogen to blow dry the slide.
e.) Immerse the slide in a small beaker of fresh DI water and sonicate for ~2min.
f.) Rinse and dry slide.

2.) Make a flow cell.

We use Scotch brand two sided (double sided) sticky tape to create channels on our microscope glass. This tape gives us flow cells that are approximately 100µm thick.

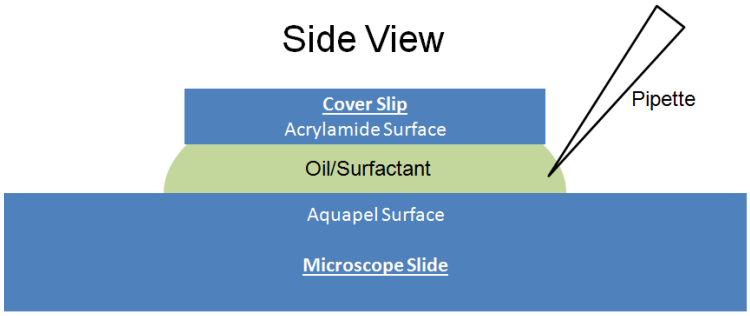
a.) Cut strips of tape and lay them onto your treated microscope slide glass to make channels. We typically make channels that are just a few millimeters wide.
b.) Lay an acrylamide coated coverslip over the tape.
c.) Use a soft, blunt tool to press the coverslip down and seal/compress the tape. Make sure there are no air bubbles or channels in which leaks can develop in the glass/tape/glass sandwich.
d.) Using a razor blade, compress the exposed tape ends by sliding the blade across the tape. This seals the tape to the glass slide so that oil will not seep under the tape.



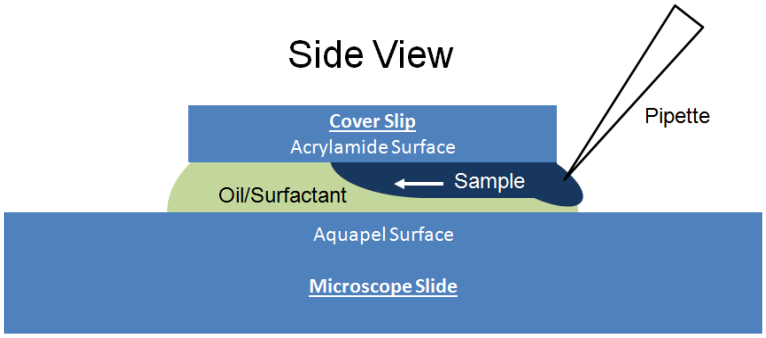
A 100µm thick and ~3mm wide channel will only require ~**5µl** of volume to fill.

3.) Oil-water interface.

a.) Flow in the Oil/Surfactant mixture. If you pipette out near the entrance to the channel, capillary force will do the work for you and draw the solution into the channel.



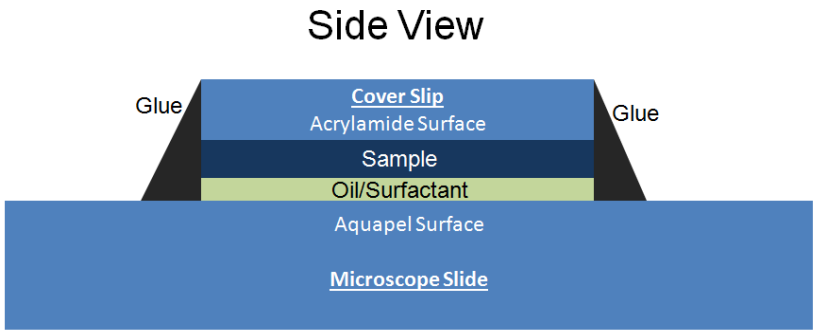
b.) Once the chamber is filled with oil/surfactant, flow in the water very slowly and displace the oil. We often use a Kimwipe at one end of the chamber to wick out the oil while pipetting in the water phase at the other end. You should see an oil/water interface moving across the channel.



4.) Seal the chamber.

a.) We use optical, UV curable glue to seal the chamber. Draw a thin bead of glue all around the device for best sealing and cure under a UV lamp.

b.) Make sure the chamber is well sealed as the oil will easily seep out.

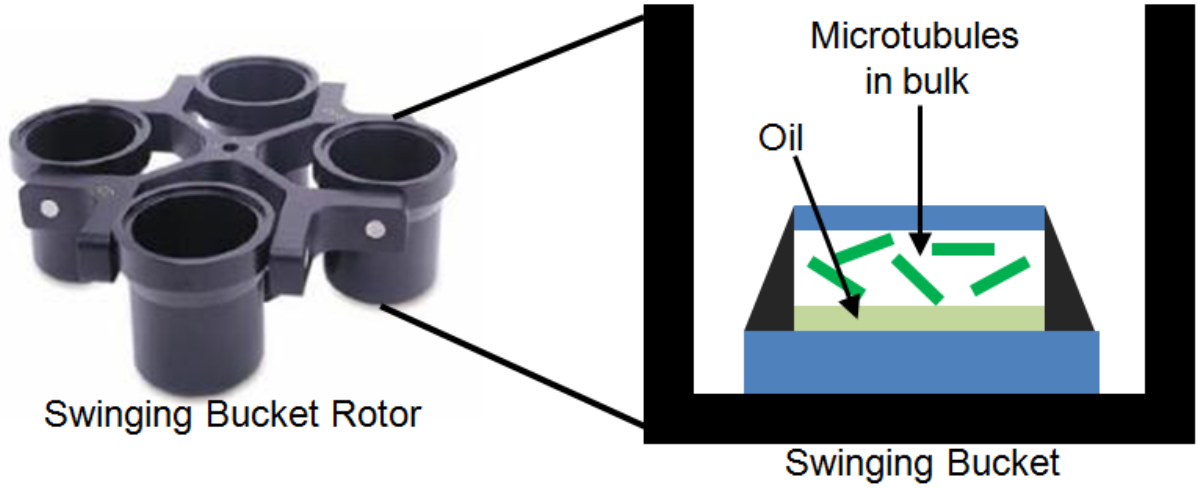


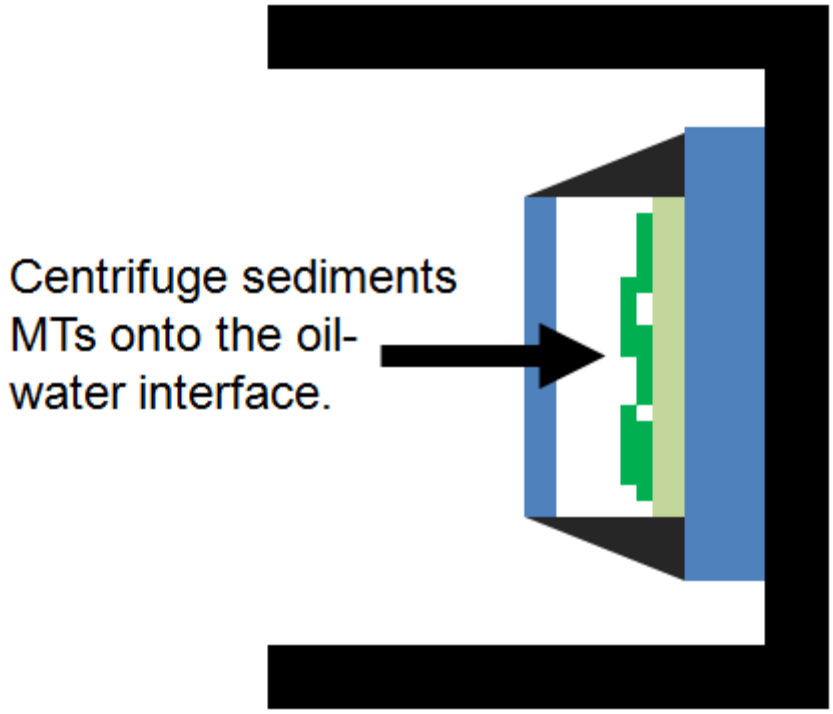
Pellet Microtubules to form Nematic

In order to quickly form an active nematic at an oil-water interface, and to ensure that all of the MTs in the bulk active sample get incorporated into the nematic, the MTs can be pelleted to the oil-water interface through centrifugation.

5.) Place microscope slide into swinging bucket rotor.

a. Centrifuge for 10min at 1,000 RPM.





Product information:

Fluorinated Oil: HFE-7500

Product ID: 98021229285
3M ID Nbr: 98021229285
Product Description: 3M(TM) NOVEC(TM) 7500 ENGINEERE D FLUID 12 LB 1 GAL

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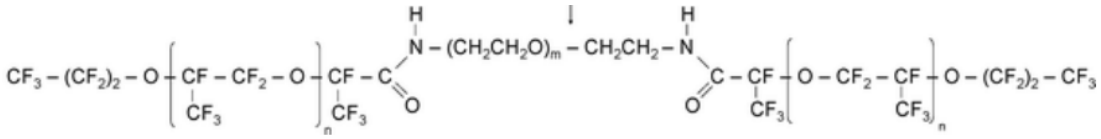
Bio-compatible Fluoro-Surfactant: E2K0660

PFPE-PEG-PFPE Tri-block-copolymer Surfactant (E2K0660)

Holtze, C. et al. Biocompatible surfactants for water-in-fluorocarbon emulsions. Lab Chip 8,1632–1639 (2008)



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