Capillary Rise as an Alternative Contact Angle Measurement

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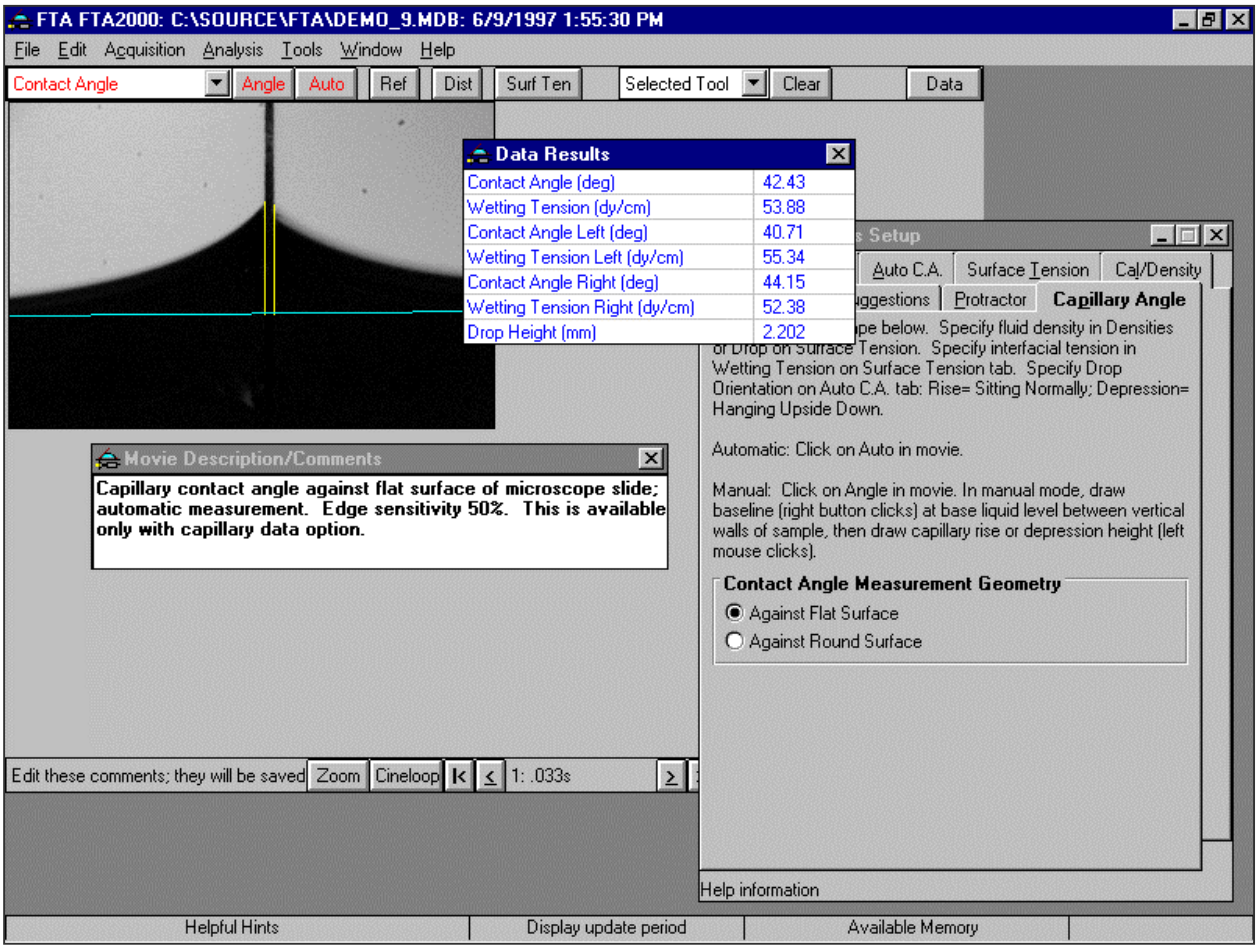
The common way to measure contact angles is with a sessile drop resting on the surface to be measured. This method has the benefit of being simple and straightforward, but does set a limit on the minimum sample size because it is difficult to deposit drops smaller than a millimeter in diameter. An alternative method is to measure the capillary rise (meniscus) of the test fluid against the sample. Whereas the sessile drop method may be characterized as "small drop/large sample" the capillary rise method may be characterized as "small sample/large drop" because the sample is lowered into a pool of test liquid.

The figure below shows an image from a capillary rise experiment. The sample is a thin microscope slide.



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The capillary rise approach is particularly suited to fibers because most fibers have such a small diameter (≈100μm or less) that it is not practical to place a sessile drop on them. A secondary advantage of the capillary rise method is the meniscus is often larger than the object, so it is easier to measure the contact angle through the relatively visible meniscus.

The mathematics for converting capillary rise, or meniscus height, are different depending on whether the sample is flat or round. The FTÅ software allows the user to use either shape. The user must provide the density of the test fluid also. The diameter of the sample must also be determined for a round specimen, but the software will measure it automatically.

Capillary rise measurements are most easily done when the contact angle is less than 90°, so there is a rise rather than a depression. When a depression occurs, the surface we want to measure is below the "waterline." When a capillary depression is observed with the arrangement illustrated on the previous page, *inverting the experiment* by having a bubble rise against the sample (say, in a closed cuvette) will result in an observable interface and measurement. The alternative is to measure the contact angle with a more wettable liquid (lower surface tension) , so a contact angle of less than 90° results and a rise is observed.

When performed in the normal way with the sample entering the liquid from above (i.e., vapor phase on top), the syringe pump carriage will lower and raise the sample through an adapter. This is a convenient way of performing advancing and receding angle experiments using the capillary rise technique.