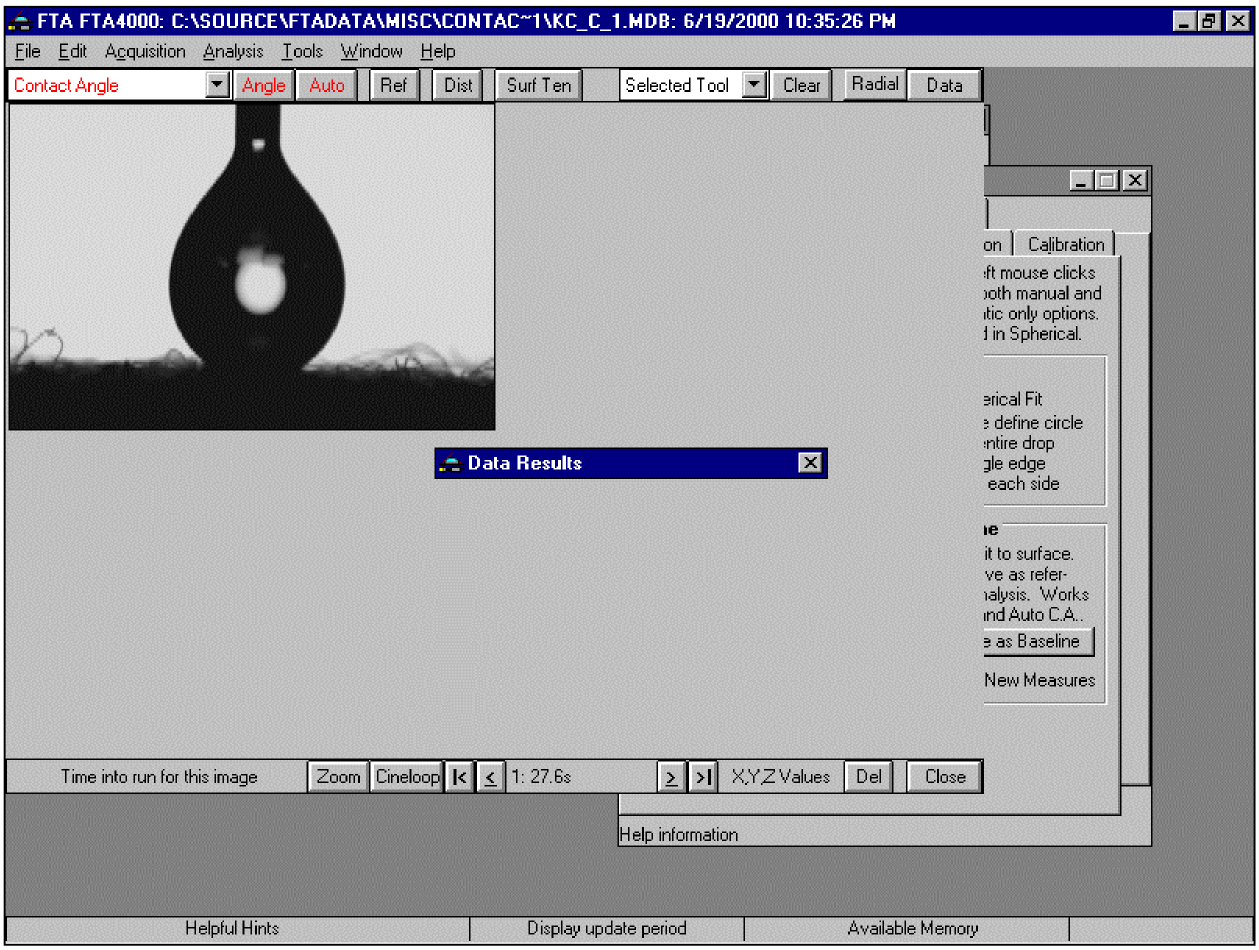
First Ten Ångstroms **ApplicationNotes**

Contact Angle on Open Weave Material

June 19, 2000

This sample is an open weave material with a reasonably hydrophyllic fiber. A consequence of this is that the material can not support a sessile drop. However, its apparent absorption is due far more to its open weave than to capillary forces. Basically water "falls through" the surface more than it absorbs into it. This was verified by conducting a capillary rise test where the sample is dipped into a beaker of water and the rise of the wetted portion noted. This sample exhibited very little rise, perhaps a mm. By comparison, an ordinary paper towel (a much denser material) will have a 10 or 15mm rise within a second or two. With this behavior in mind, the following images illustrate its behavior.



Pendant drop about to touch sample. Time is 27.6s into run.

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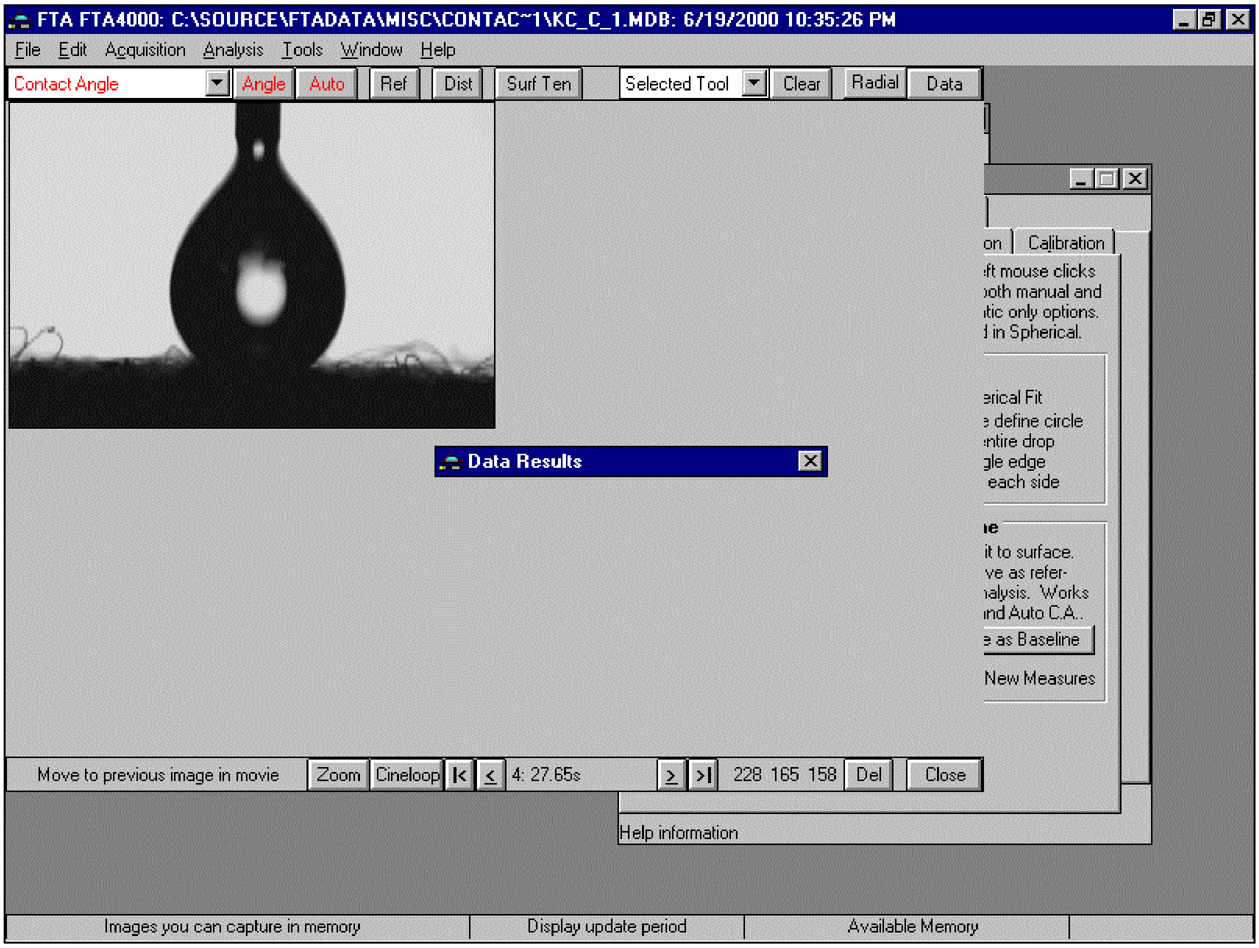
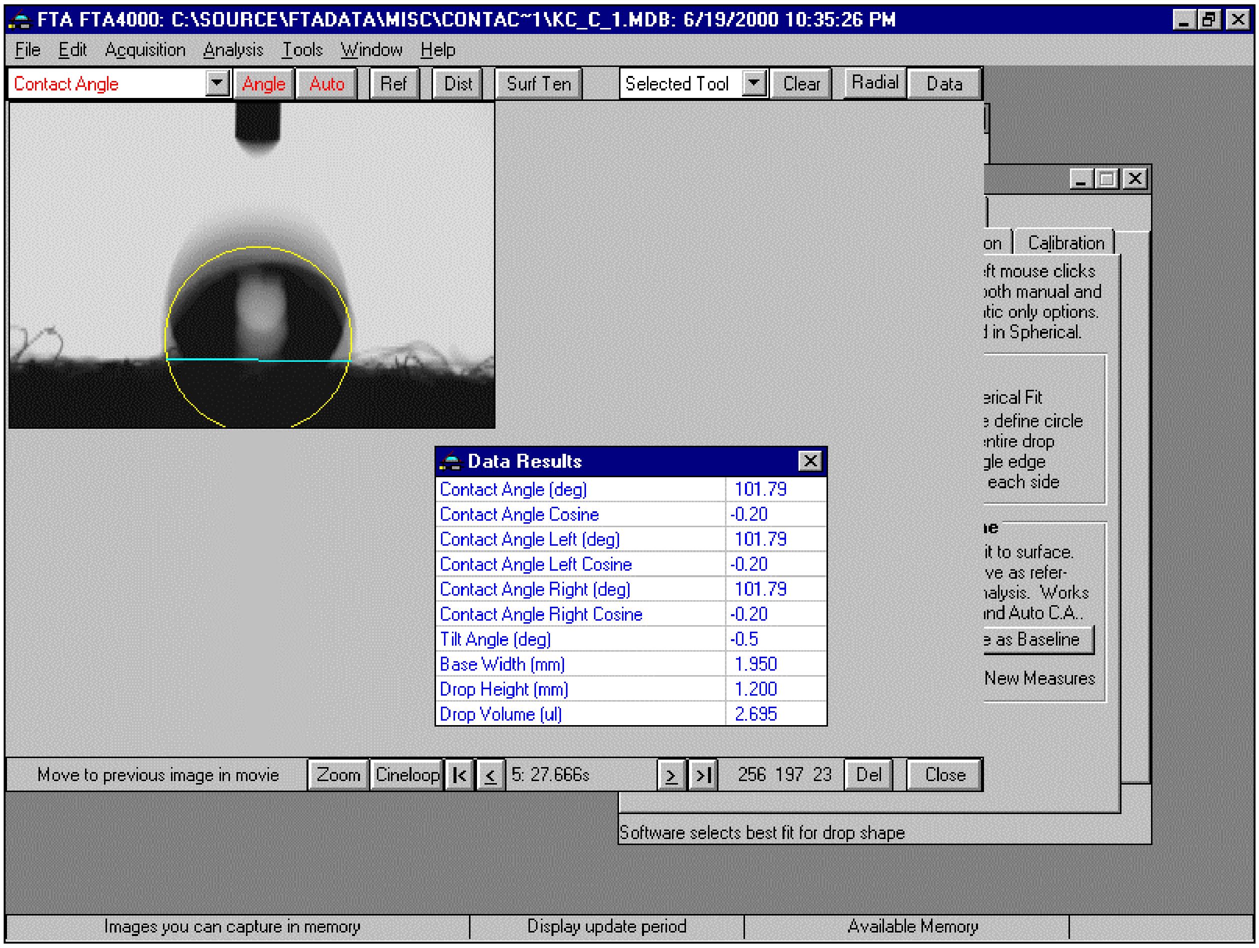


Time is 27.650s, 50ms later.

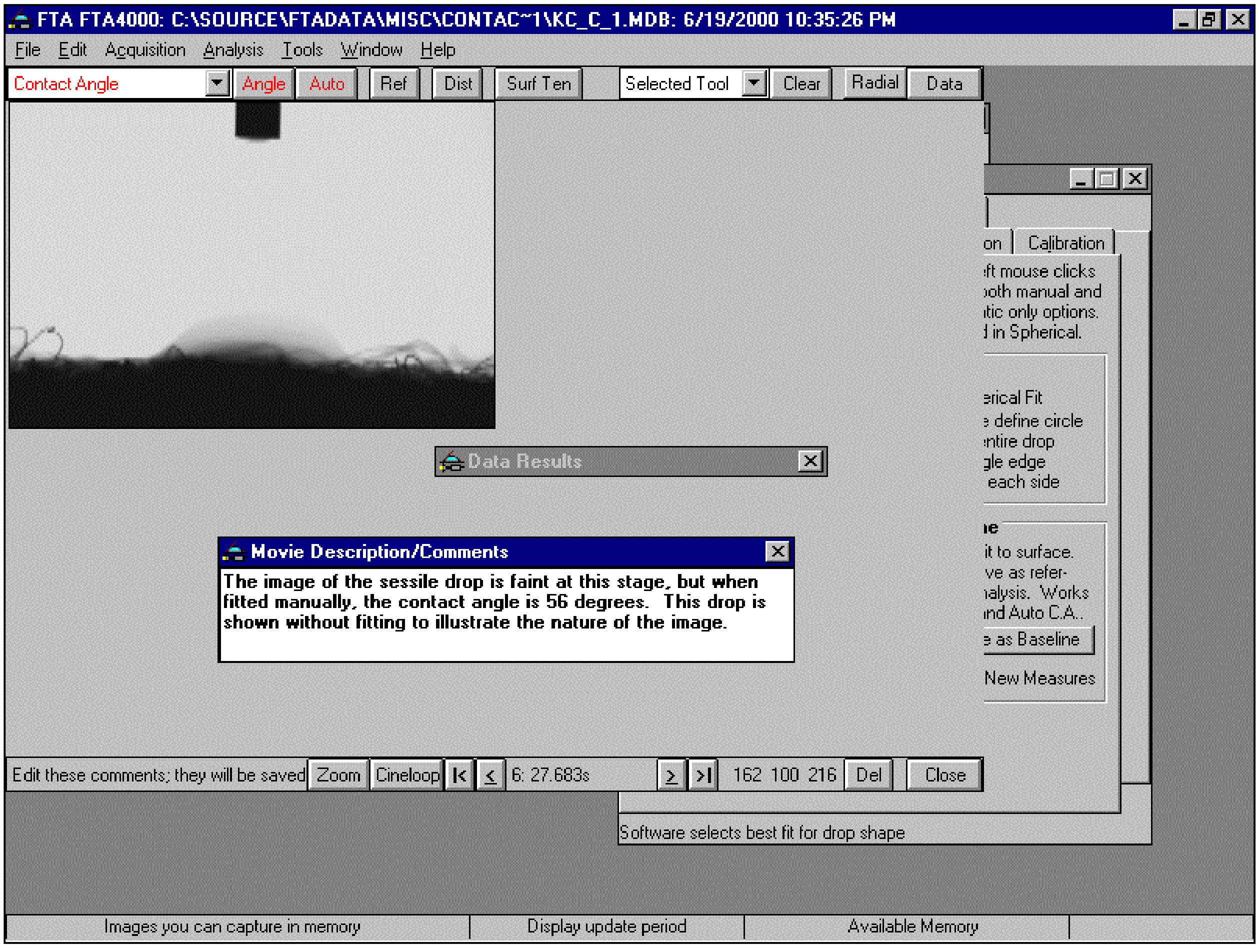
50ms later the pendant drop has only partially detached from the tip. Basically the surface is "pulling" the drop down from the adhesion to the fibers, but this force has not yet overcome the cohesion to the liquid in the needle. On truly high energy (wettable) surfaces, this same drop would have detached instantly upon touching the surface. However, the open weave of the sample limits the total adhesive force available. On some runs, the drop would be pulled to one side or the other at this point, illustrating the adhesive pull of the sample (i.e., this is not simply gravity).



Time is 27.666s, 1/60s later.

Drop detachment finally occurs. The image is the equivalent of a multiple exposure since the drop is moving during the open aperture time of the camera. The initial stable angle is fitted manually in spherical mode. This image is 16.7ms after the preceding one.

In the image on the following page, 16.7ms later the observed contact angle is 56 degrees but the drop did not remain for the full image time, hence its faint appearance. Interestingly, the drop shows no spreading (spreading being common with absorbent materials); instead, it is absorbing straight down.



Time is 27.683s, another 1/60s later.

The contact angles can be summarized by the following table:

Time	Angle
27.650s	touching, but not detached
27.666s	102°
27.683s	56°
28.000s	0°

The time to absorb can be roughly estimated at 33ms. By way of comparison, some absorptions truly take place in less than one image time, or less than 16ms.

The fact that the drop does not detach immediately, the base width does not increase during the absorption, and the lack of capillary rise all indicate this material is dominated by its open weave. One would not expect it to be able to absorb the same mass of water as a more closely woven paper towel, say.

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