Contact Angles on Lens

April 05, 2000

Sessile drop contact angles were measured with water on two types of plastic lens with a standard FTÅ200 instrument. One lens had an antireflection coating and the other did not. The purpose of the measurement was to both show the differences between the lens coatings and the process of making measurements on the "side" of a lens where the surface is obviously not flat. A secondary purpose was to see if the curvature of the lens was sufficient that local baseline correction was necessary.

As the following images will show, the lens appears "tilted" at different locations but straight within the small distances occupied by each drop. Therefore, use was made of the instrument's software to correct for the tilt, but the optional correction for local curvature was not required. Finally, the non-coated lens had a typical water contact angle of 50° and the AR coated lens had a much different contact angle of typically 115°.

AR Coated Lens

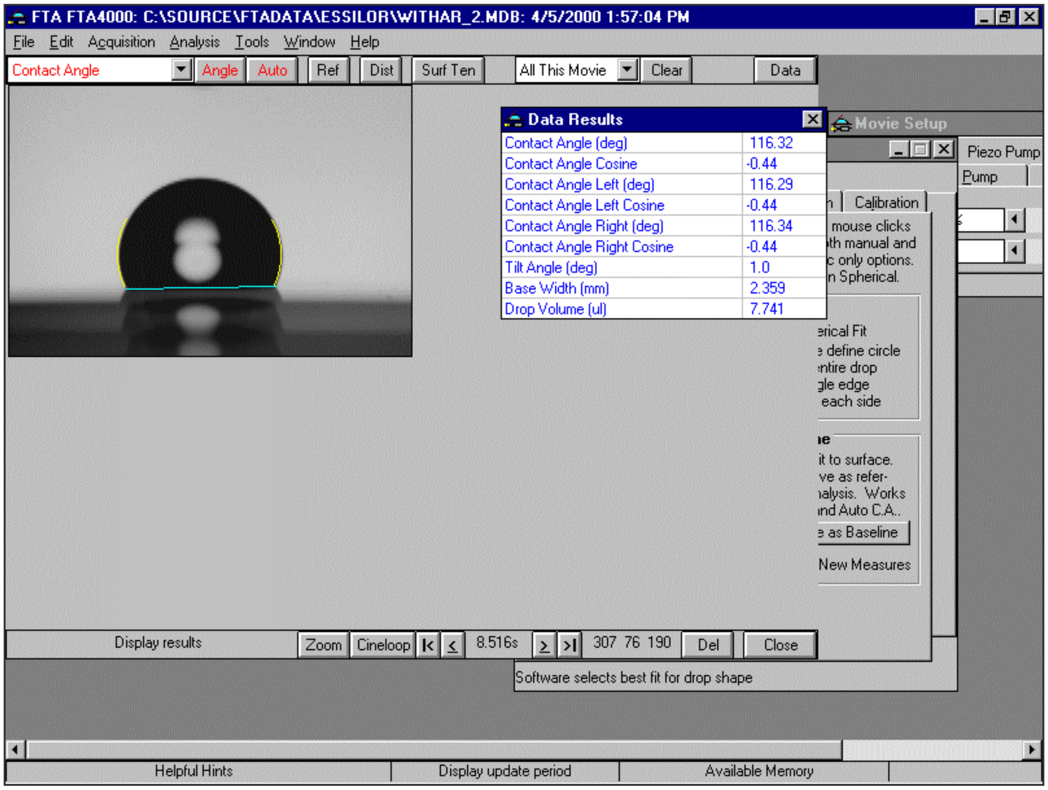
Measurements were made a meridian across the surface so the drop was always sitting on the profile of the lens and clearly visible. A measurement was made at the top, where the surface was nominally level, and about two thirds of the way down the left and right sides, where the surface was definitely not level.

The image on page 2 shows the drop on top, with a level baseline. Actually, you will note the baseline tilt angle is measured, and is 1° in this case. The contact angle is 116.29° on the left side of the drop and 116.34° on the right side. This is not to suggest that contact angles can be measured to .05° accuracy, but rather the left and right side angles are measured independently (in what we call non-spherical mode) and that they are nominally the same with this level drop. Many things can be graphed when movies are taken. The graph on page 2 shows the average contact angle and the drop's base area for the image.

Page 3 shows drops on the left and right sides of the lens. Notice the "downhill" side is always similar to 115°, but the uphill side will be less as a result of the uneven hydrostatic pressures in the drops. The important point is the downhill side is the advancing contact angle, which is what we desire. In the case of the level drop on page 2, both sides are "downhill."

Non-AR Coated Lens

Non coated lens behaved much differently. The most interesting (or, at least, amusing) aspect was the high static electricity charge on the lens. This pulled the dispense drop to one side. The images on page 4 show an attempts to deposit a sessile drop on this surface. The pull to the left was very strong.



AR coated lens, on top with nominally level baseline.

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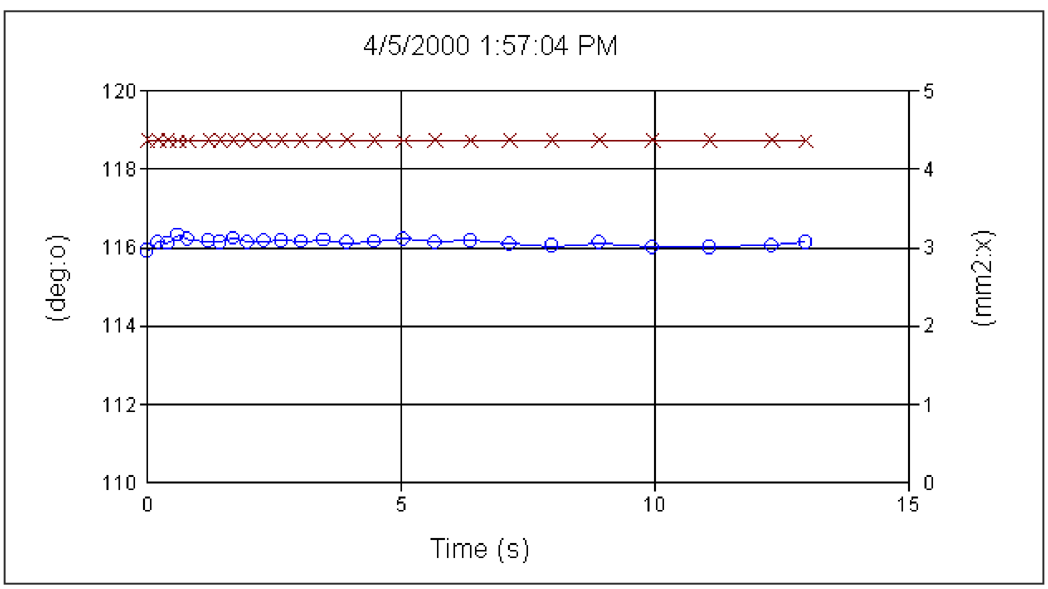
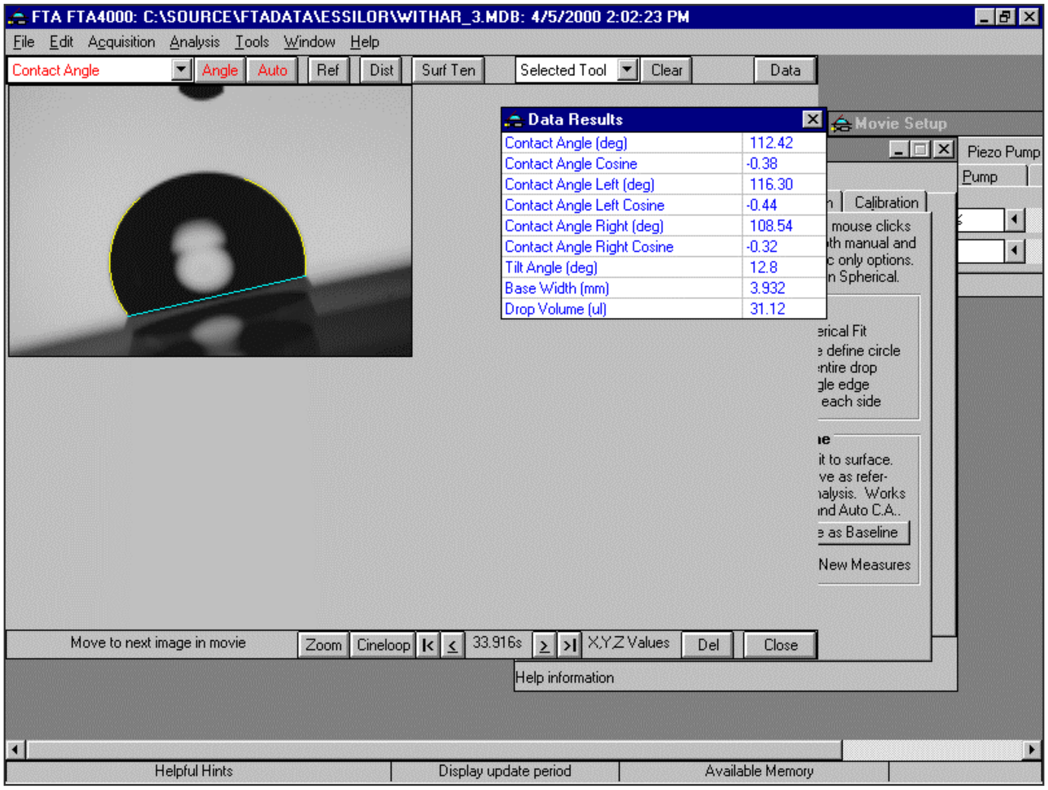
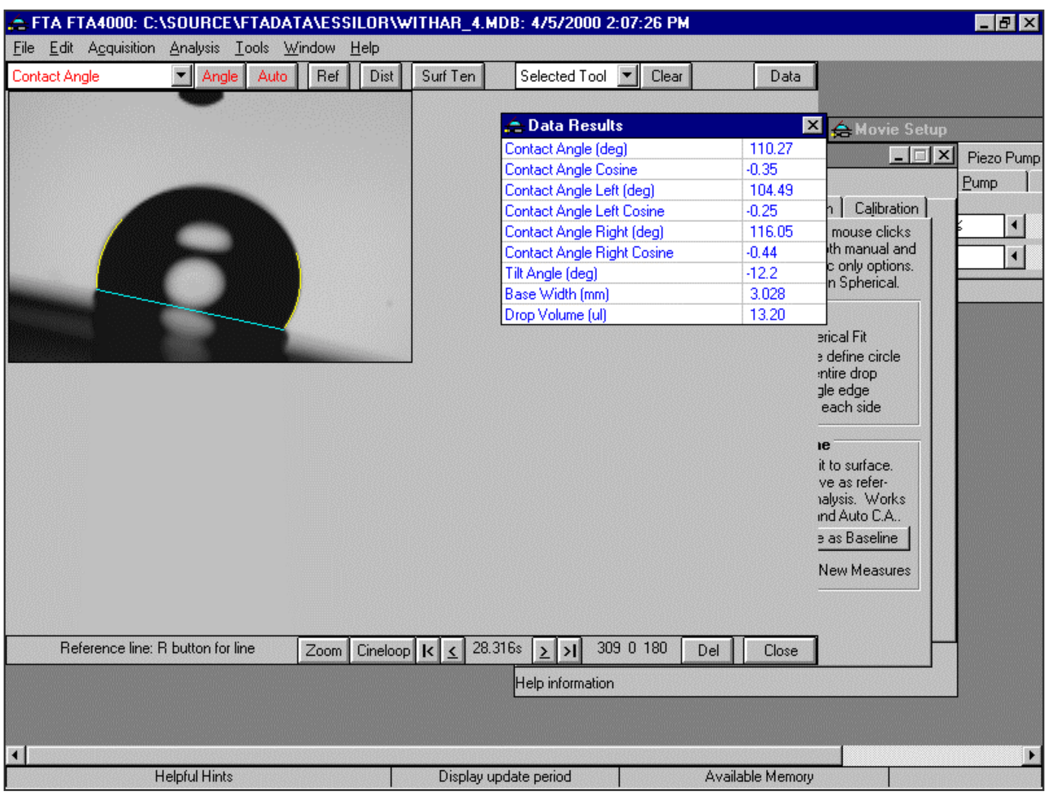


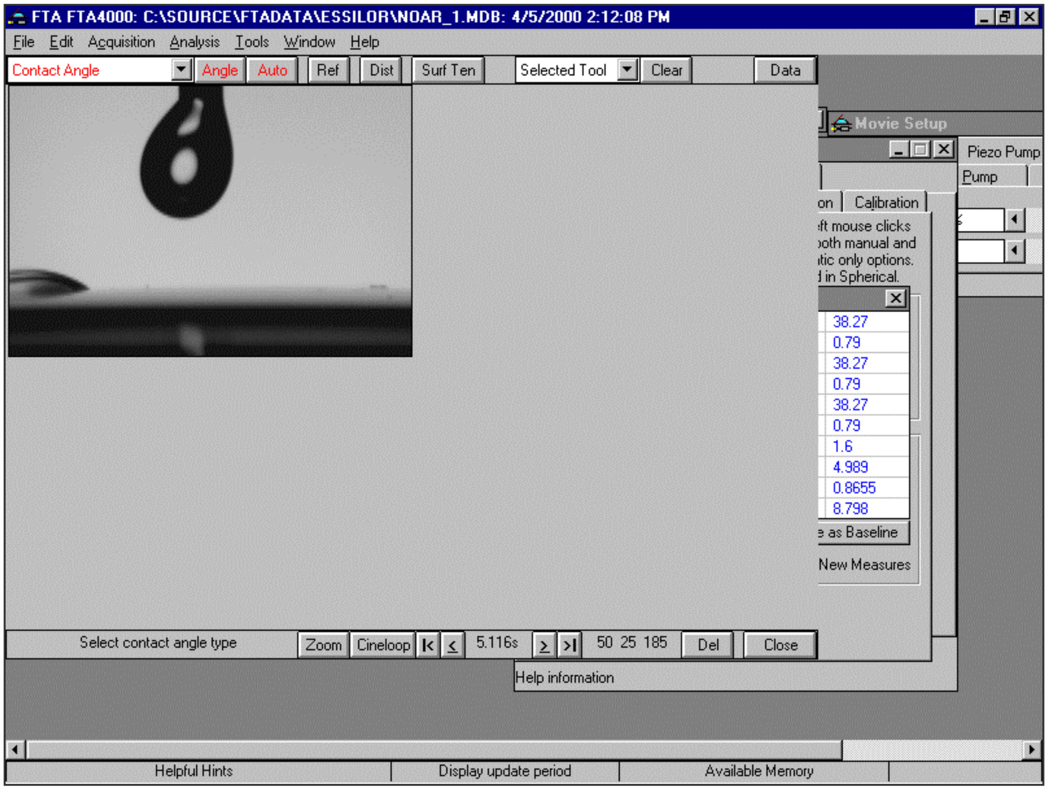
Average contact angle (left) and drop base area (right) as a function of time.



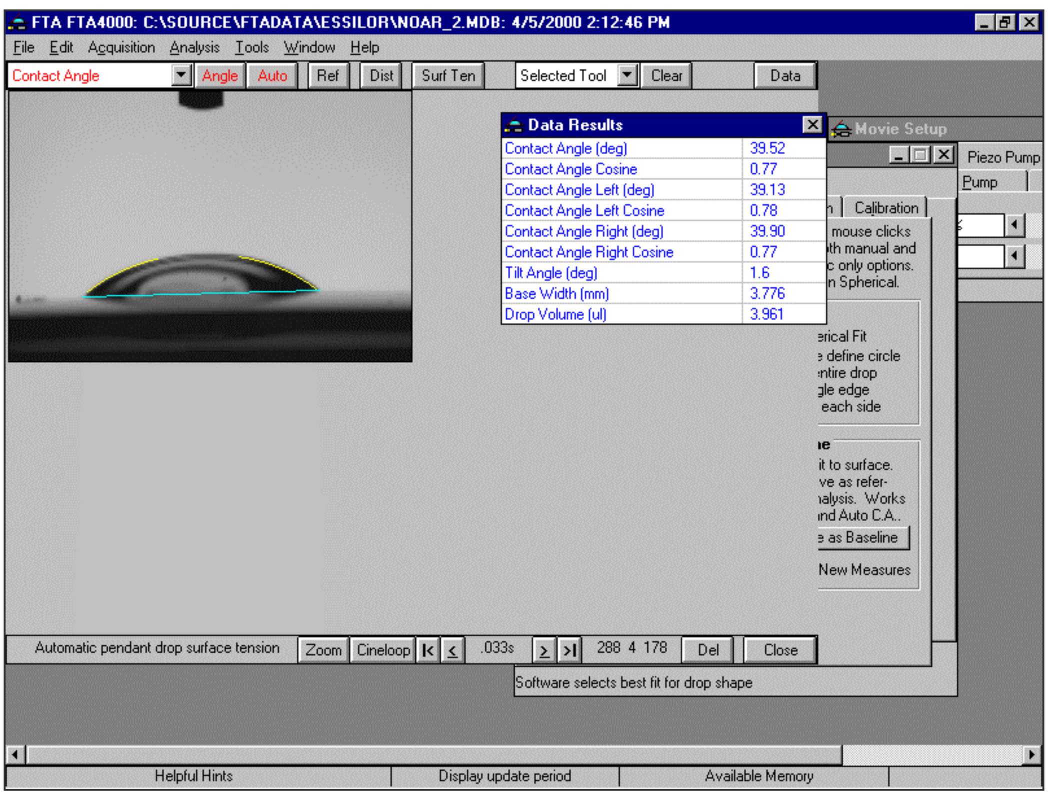
AR coated lens on the left side. Note Contact Angle Left.



AR coated lens on the right side. Note Contact Angle Right.



Showing static electricity on non-coated lens.



Contact angle on non-coated lens on non-charged region.

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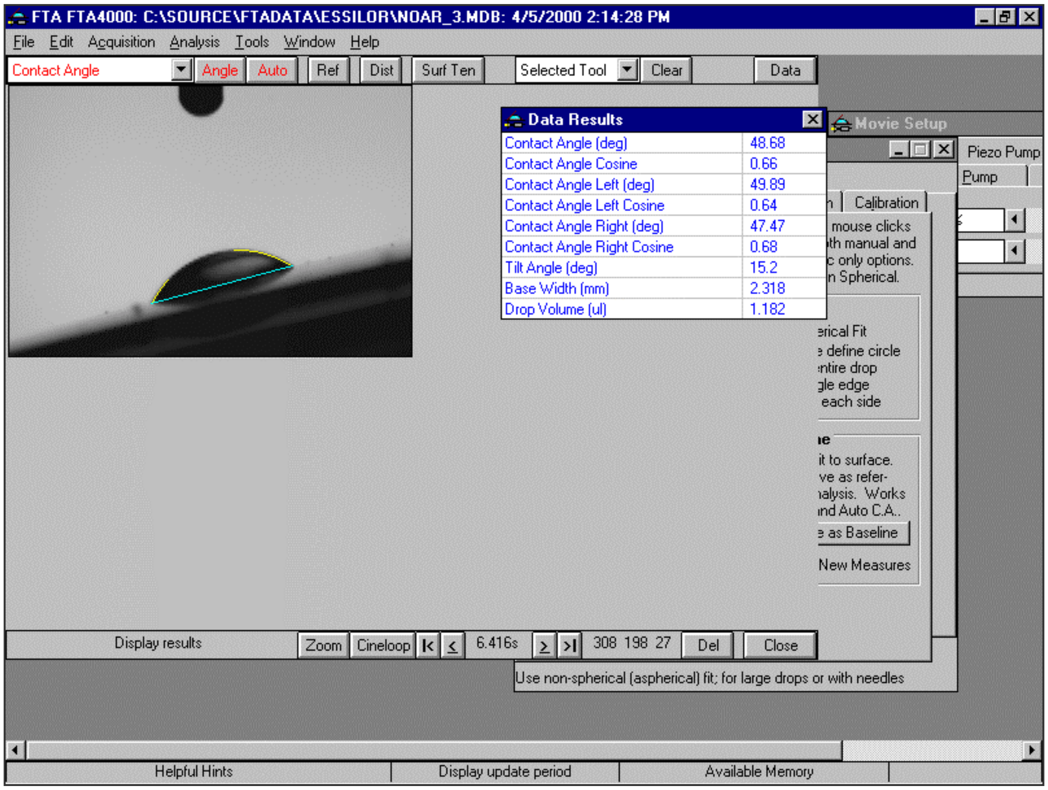
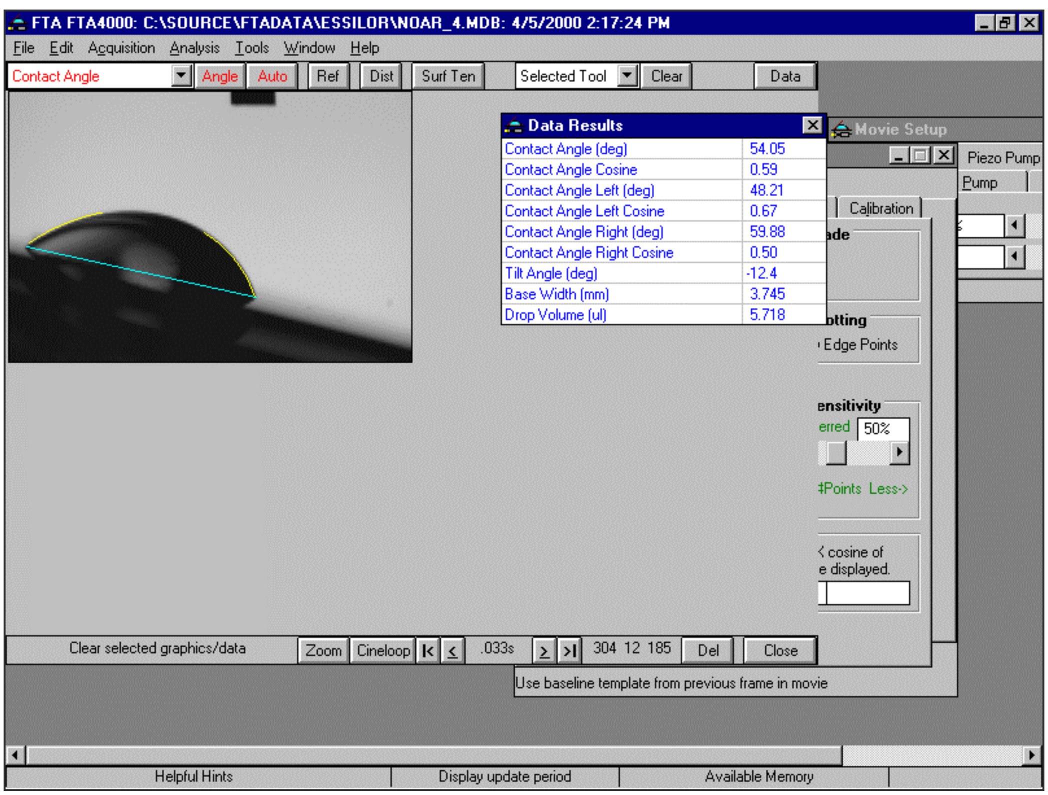


Contact angle on left side of non-coated lens. Note Contact Angle Left.



Contact angle on non-coated lens, right side. Note Contact Angle Right.

After some effort, a reasonable sessile drop was deposited on the level surface. These are shown on the previous page. The "downhill" angles on these are 49.89° and 59.88°. This sort of spread is not unusual on high charged surfaces, because charge will affect contact angle and the surface is not charged uniformly. No effort was made to discharge the surface, but such could be done before making measurements.

Summary

Contact angles can be measured on curved and tilted surfaces using software baseline corrections. The user must select which is the downhill, advancing angle for each case.