Notes on FTÅ4000 Applications

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This instrument combines two important capabilities:

- Ability to form, image, and analyze droplets and their contact angles over a wide range of volumes--from tens of picoliters to microliters.

- Ability to analyze surface tension from both drop shape and internal pressure perspectives.

Two video cameras provide both side-on drop profiles and look-down (at 45°) perspectives of the droplets and their surroundings. Movies may be captured from either camera. Zoom microscopes are employed on both cameras. Magnification can be scaled by using different adapter tubes before the cameras. Horizontal field-of-view ranges from less than 0.200mm (200 microns) to almost 10mm. Image capture to 60 images per second is standard. Higher rates are available as an option, if needed, and slower and variable rate capture for movies are standard. Movies are stored in the main RAM of the computer and can be hundreds of images long. Movies can be triggered by extrenal signals. Two adjustable fiber optic illumination sources are provided.

The instrument has a cascaded pumping system to precisely deliver fluid droplets over an extremely wide range of volumes. The trick at small volumes, of course, is not to impart any momentum to the droplet during its formation. This is accomplished by using a piezo electric element to apply pressure to the fluid in the dispense tip. Large volumes are dispensed via a traditional stepper motor driven syringe pump and glass syringes. The piezo electric pump is placed between the syringe pump and the dispense needle, so the syringe pump pumps through it. Dispense needles can either be stainless steel or drawn glass capillaries.

A pressure sensor is incorporated into the piezo electric pump so the pressure can be regulated to control small drop dispense. The sensor can also be used to determine surface tension if the drop radius of curvature is known. The video system can measure drop radius of curvature, allowing surface tension determination from Laplace's equation. This is a useful alternative when small volumes (less than 5µl) are to be measured.

An acrylic chamber is available for humidity and temperature control. The standard unit is suitable for specimens in the 10 or 20mm size range. Larger chambers are available. Peltier heating and cooling is provided for temperature control from 10 to 50°C.

465 Dinwiddie Street • Portsmouth, Virginia 23704 • 1.757.393.1584 Fax: 1.757.393.3708
http://www.firsttenangstroms.com