Micro Contact Angle Measurements on Single Particles, Filaments and Patterned Surfaces

The micro contact angle meter we have in our Nano Analytical and Testing Laboratory (NAT Lab) is specially designed for the pioneers in the micro/nano fields. The instrument is equipped with a unique capillary liquid dispensing system that has an inner diameter of 5-50µm, for making a liquid drop <30µm in size and picoliter to nanoliter in volume. In addition, the instrument comes with orthogonal vertical and horizontal high magnification optics for accurately placing and measuring such small drops on micrometer features, and CCD cameras with high capturing speeds of 60 frames per second for studying dynamic characteristics of interaction between micron size liquid droplets and solid surfaces.

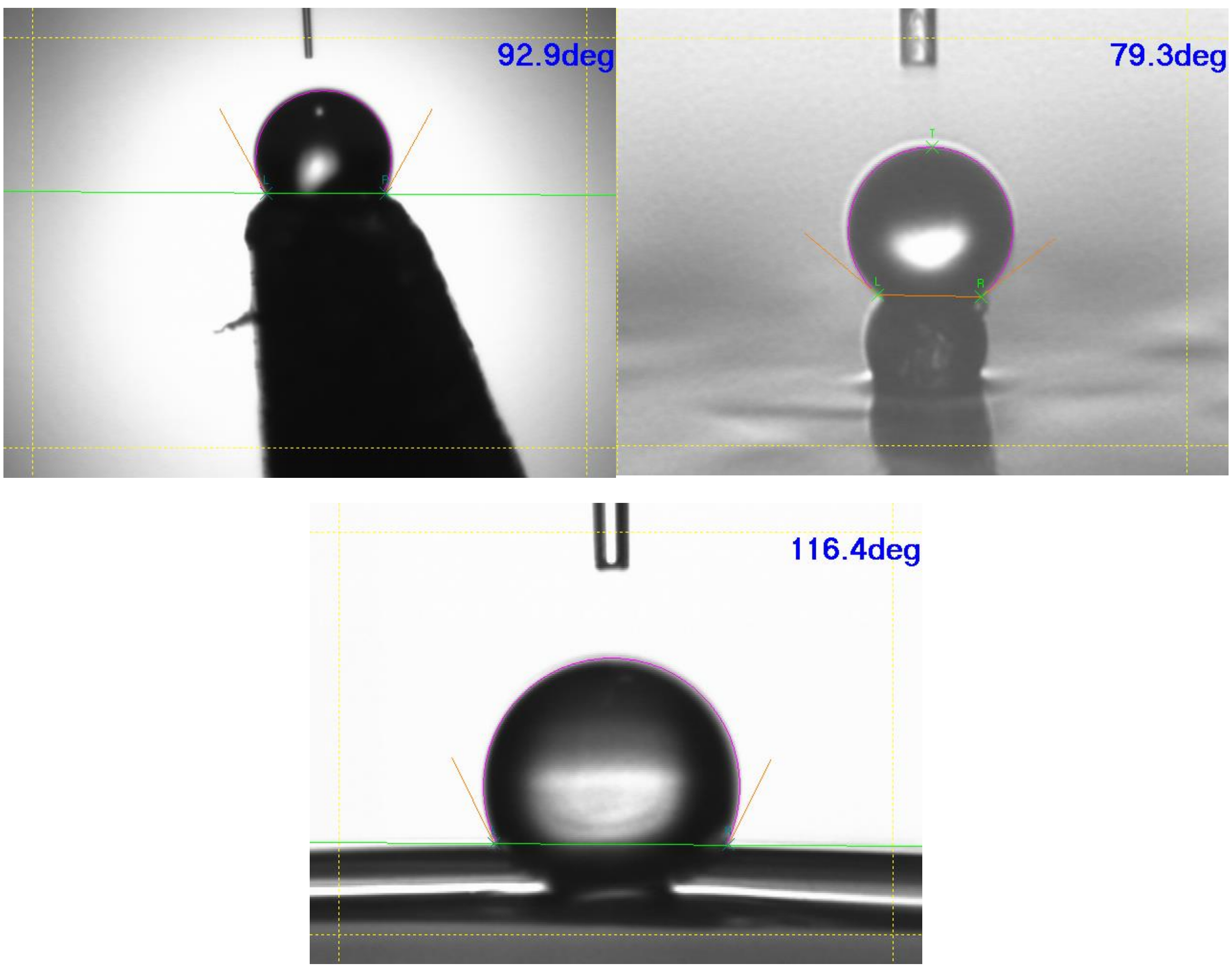

Figure 1. Captured droplets used for micro contact angle analysis on a 140 µm hydroxyapatite coated Ti post (top left), 30µm Al_2O_3 particle (top right) and 20µm polymer fiber (bottom).

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In synergy with its sensitivity of detecting monolayer molecules, contact angle measurement at microscale has been proven to be an ideal and indispensable tool to study surface properties of single particles, filaments, fibers, medical lead and guide wires, patterned organic light emitting display, microcircuits, microfluidic channels, micropatterned surfaces, lotus effect, and high-speed ink-jet printing. The high speed capturing capability of the instrument is deemed advantageous in determining strong dependency of contact angles on time at millisecond intervals. The recorded feature-rich dynamics of micron size drops is valuable for investigating sensitive surface chemistry, vapor evaporation and adsorption, surface contamination and cleanliness, wettability, hydrophilicity and hydrophobicity changes at micro/nano scales.

The captured images shown in Figure 1 exemplify the types of surfaces that can be tested with the micro contact angle meter. Using the vertical high magnification optics, a micron-sized droplet was accurately placed on a small hydroxyapatite coated Ti post on an orthopedic implant, a single Al_2O_3 particle, and a polymeric fiber used in baby diaper products. Then the software determined the contact angles using one of several curve fitting routines based on the captured image of the cross-sectional profiles of the sessile drops. Please note that a curvature correction routine standardized in the measurement software has been applied to the contact angles measured on the curved objects. The actual contact angles are much smaller than those appeared on the images when flat baselines are used.