A Comparison of Dyne Inks and Dyne Pens with the Surface Analyst™

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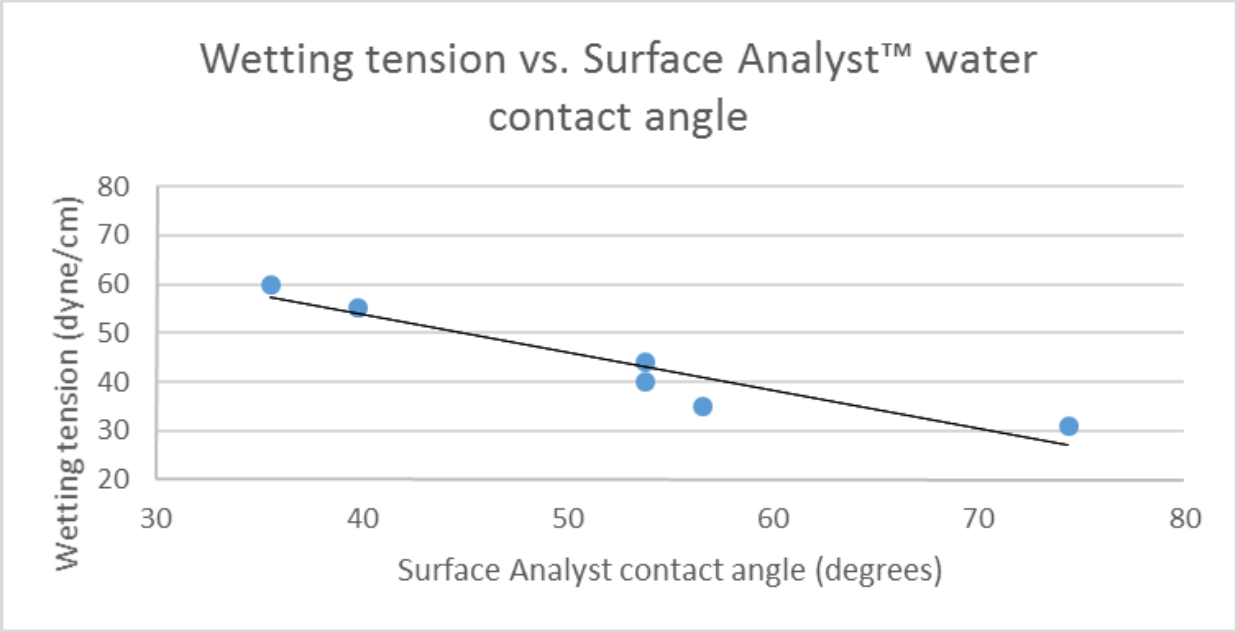
Dyne inks (whether applied by cotton swabs or by using a dyne pen) provide an estimate of surface energy; what they actually measure is a property called *wetting tension*[1]: this is the surface tension of a liquid (a blend of either formamide and 2-ethoxyethanol or ethanol and water) that will just wet the surface (i.e. not bead up) under a carefully specified set of application conditions. The surface tension of this liquid is related to the surface energy of the substrate.

While suitable in some cases for estimation of surface energy (and therefore cleanliness or treatment level), the imprecision and subjectivity of wetting tension measurements makes them a poor choice for quality assurance and process control of surface cleaning, surface treatment, bonding, coating, and printing operations. Dyne inks are also destructive to the surface being measured. An alternative method for gauging surface condition and consistency is the Surface Analyst™, which provides a rapid, automated measurement of the water contact angle in a precise, controlled manner. This contact angle is determined by the surface energy of the substrate and the liquid and how strongly they interact with each other. This water contact angle correlates very well with the cleanliness and consistency of a surface.

Because wetting tension values obtained using dyne inks and dyne pens are currently in common use, a quantitative correlation between water contact angle values obtained with the Surface Analyst can be useful for users used to thinking in dyne ink terms. The example here was generated using ethanol based dyne test inks for wetting tension measurements, and a BTG Labs Surface Analyst for ballistic water contact angle measurements. The Surface Analyst is a fast, easy, accurate, and nondestructive instrument that identifies substandard surfaces and track the effectiveness of your surface preparation processes. The correlation is approximately linear over a wide range, but the exact form will depend in part on the particular material and surface treatment under consideration.

In this example, atmospheric pressure plasma treatments (using a Plasmatreat atmospheric plasma system) were used to activate the surface of two different polypropylene automotive molding compounds. The treatment level was controlled by controlling the distance of the plasma jet to the surface and the residence time of the surface under the jet. After each treatment, contact angle and dyne ink measurements were made. The Figure shows the relationship between the surface tension of the dyne test ink and the water contact angle.

[1] ASTM D2578, Standard Test Method for Wetting Tension of Polyethylene and Polypropylene Films



In the range of dyne test inks used in this evaluation—30-60 mN/m—the relationship between wetting tension and contact angle is quite linear. This relationship allows BTG Labs to provide the option of dyne readout on the SA3001. Customers who are accustomed to dyne readings can easily have the option of continuing to utilize that scale.