CONVERTING SUPPLY, INC.
Solving Your Extrusion and Converting Needs

Dyne Testing – Why Test In The First Place?

By Marc Nolan-Converting Supply Inc.

Today, more than ever film extruders, laminators and printers need to be concerned about the level, quality, and consistency of treatment they achieve or receive on their film. In addition to concerns to retain customers and preserve bottom line profits, the reality is without proper treatment verification methods sometimes the problem is detected post production which is often too late. Botched production is often also environmentally very unfriendly.

We don't buy car insurance to confirm we are bad drivers rather we buy it as protection. Like Auto insurance, using proper dyne checking methods can help post production to insure substrates are properly treated. The rest of this article will talk about the importance of using consistent surface testing test methods and proper dyne solutions.

Testing materials to verify treatment levels have been around for decades. For some companies using a contact angle measuring device was the best most accurate method for checking materials. Fig.1 represents a surface that supports adhesion and the droplet of liquid is wetting out to the surface.Fig.2 is an untreated surface and the droplet is clinging to itself rather than the solid surface.

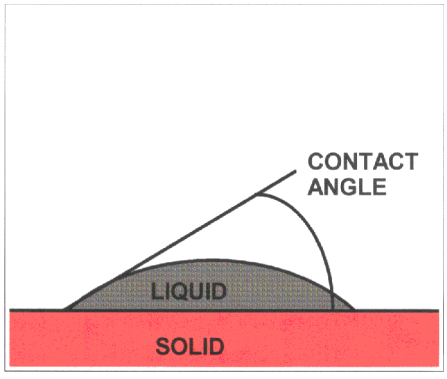


Fig.1

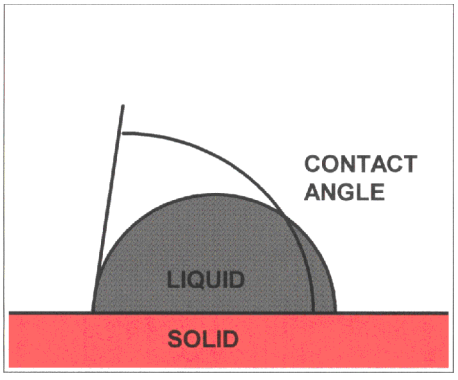


Fig.2

The use of contact angle measuring devices is impractical in a normal manufacturing environment, so one alternative is to use dyne solutions and apply the solution to the solid surface.

Conceptually, we test as a means to pre-check that surfaces are properly prepared to interface with each other and “support” adhesion.
In a printing operation for example, we typically target for the substrate to be approximately 10 dynes higher than the wetting tensions of the ink being applied.
This is what is referred to as measuring the surface tension.

Surface tension is the property of a liquid arising from unbalanced molecular forces at or near the surface. If it is higher than the surface energy of a material, the liquid tends to form droplets rather than spread out or “wet out” as some refer to it. Surface tension is normally measured in energy units called dynes/cm. A dyne is the amount of force required to produce an acceleration of 1 cm/sec² on a mass of 1g.
The dyne level of a material is called its surface energy. If the liquid has a dyne level lower than the material’s surface energy, then the liquid will spread out over its entire surface in a uniform wet layer. If the ink’s dyne level is equal to or higher than a material’s dyne level, the liquid will become cohesive and tend to remain in droplets.

Surface test fluids were introduced to give an accurate measurement of graduated surface tension levels. The fluid is applied to the surface or substrate until a satisfactory dyne level is found. In many instances using bottled solutions is normally reserved for a lab type setting where samples of substrates are tested by a lab technician using a graduated set of solutions and cotton swabs. This method although accurate is still interpretive and is not so shop floor “friendly”. The need for a more shop floor friendly dyne pen led to the development of dyne pens that are also based on a graduated dyne level system. These pens are similar to a felt tipped highlighter marker and contain the same solutions as in the bottles. The felt tip is swiped across the surface of a material and the results are interpreted in the same manner as the solutions and cotton swab method. The difference is the felt tipped pen offers convenience.

The interpretive nature of dyne solutions and pens remains a variable and two users will often interpret results differently. In many instances, dyne testing is a mechanism to check for the presence of treatment rather than check specific levels of treatment. This precipitated the further development of another pen that is alcohol based, quick drying and really meant as a go, no-go test pen for "on the fly" type testing. This pen is often referred to as a poly-test pen. The solution contained within the pen checks a range-typically between 38-40 dynes. Poly-test are by no means an accurate test method but they do serve a valuable purpose in an "on the fly" scenario.

There are many variations of dyne test pens. Most follow a theme based on a felt tipped pen containing dyne solution. The felt tipped pens offers a relatively consistent "lay-down" of test solution and is easy to use.
The solution corresponds to a specific level and generally a good practice is to use solutions that are mixed in accordance with the ASTM standard 2578.
The ingredients used in the formulation of each pen level are specifically defined by ASTM., and are composed of blends of Ethyl Cellosolve, Formimide and pigment to help with visibility. Any deviation from this standard negates the purpose of testing as in theory it's like cheating on a test.

For some companies, the alternative pens that are quick drying, offer foolproof advantages, but a cautionary word on such pens. They are typically alcohol based and prone to wider ranges of inaccuracy due to the evaporative effect from continued use. In other words, as they are used they dry out and as they dry out the results may look good but are likely imprecise. Likewise, pens promoted as being "environmentally safe" or "non toxic" have questionable accuracy and repeatability at best. These pens do not comply with any ASTM standard and are unregulated. Therefore you have a quality control mechanism that is made without any measureable standards or conformity.

In recent years the introduction of alternative test pens that work more like a bingo dabber and promoted as less likely to become contaminated offer no real advantages. If anything the method of "flooding" the test area is more likely to render exaggerated inaccurate results. In addition, lack of care when using this type of

dispenser can lead to contaminants being pulled back into the bottle causing the solution to become contaminated.

There are some measurable advantages to using a dyne solutions/pens mixed to ASTM standards. Aside from the day to day in-house quality standards, today we work in an ever shrinking global village. Using ASTM compliant solutions means the tests conducted by you and your customer should theoretically be more closely accurate.

Regardless of test discipline used, it is important for all test facilities to adopt a system to regularly replace test pens/solution so to ensure accuracy.
Pens that are stale should not be trusted.

Testing Procedure Tips- Solutions conforming to ASTM standard-2578

• Spread the test fluid from the felt tip pen lightly over an area of approximately 7 cm of the test specimen, noting the time it takes for the continuous film of ink to break into droplets.

• Breaking of the fluid into droplets in less than 2 seconds indicates a lack of wetting and a lower numbered test fluid should be tried.

• If the fluid remains intact for longer than 2 seconds, a higher numbered test fluid should be tried.

• The aim is to establish the lowest reading at an optimum dwell time of 2 seconds.

• Extreme care must be taken to ensure the film surface is not touched or contaminated in the areas in which the tests are to be made.

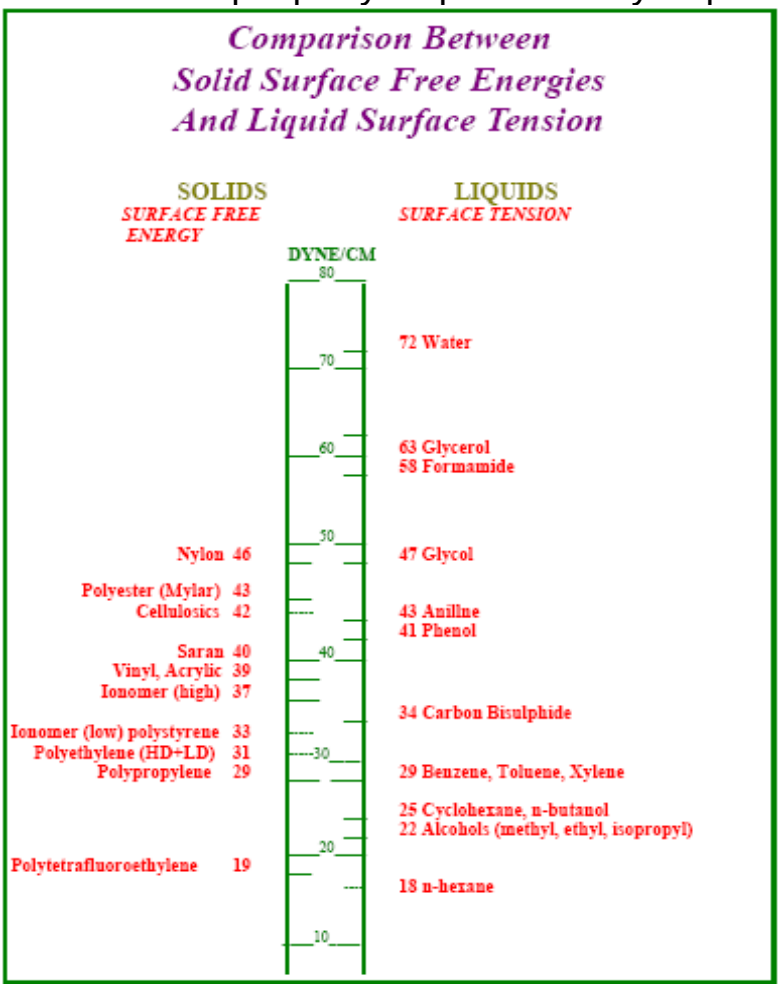
• We recommend the replacement of the inks regularly if the bottled inks are frequently opened to atmosphere.

* If bottled inks are exposed to the air on a daily basis: dispose of remaining inks after 3 months.

* If bottled inks are exposed to the air on a weekly basis: dispose of remaining inks after 6 months.
* If bottled inks are exposed to the air on a monthly basis: dispose of remaining inks after 6 months.

Key to the success of testing surface tensions is the freshness of the test fluids.
Using stale dyne solution defeats the purpose of testing at all as the results achieved cannot be trusted to be accurate. A proper procedure should be adopted whereby pens are checked, certified and replaced on a regular basis.

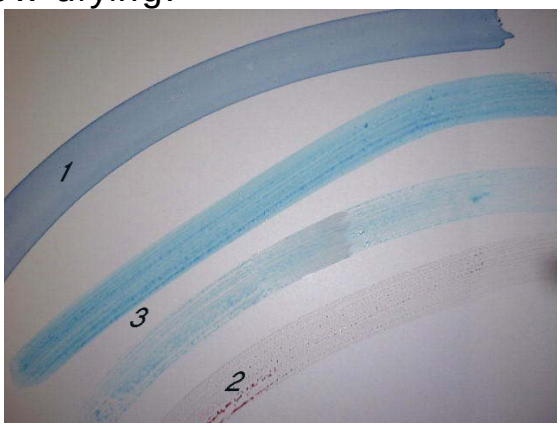
Note:
Disposal of dyne solutions is typically a locally regulated function. We recommend you contact your local municipality, or disposal service to learn how to properly dispose of any expired dyne solution



Disposable Surface Tension Test Pens

• Ideal for Cast and Blown Film Producers, and Converters needing a quick, mess free means to test surface tension “on the fly”.

Converting Supply Inc. Poly-Test dyne pens work just like magic markers, so users can quickly draw a line on the desired material. Like the dyne solutions, the operator draws a line on the substrate and counts two seconds. This type of pen is the ideal tool for operators to use on an hourly basis just to confirm the presence of treatment and to adequate levels. This pen contains solutions mixed to ASTM standards and will be very slow drying.



Results:
1.Properly Treated: The ink lies evenly on the material in a continuous line. There is no ink reticulation. The surface tension of the material is at, or higher than, the dyne level of the ink.

2.Not Treated: The ink reticulates into droplets. The surface tension of the material is well below the dyne level of the ink.

3.Partial Treatment: The ink line is defined but there is partial reticulation from the edges. The surface tension of the material is just below the dyne level of the ink.

These pens offer the following:
• Pre-filled for ease of use
• Cost effective
• Long service life
• 6 month shelf life maximum
• Safer – no filling or risks associated with chemical handling
• Less likely to become contaminated
• Available from 32-58 dynes in even dyne levels only.

E-Z Read Poly Test Pens a foolproof pen specifically developed for the blown film industry.

Converting Supply Inc. E-Z read Poly Test Pens are quick and convenient to use to determine treatment level between 38 to 40 dyne/cm. This unique pen is very easy to read. When the level of the substrate is below 38 dyne/cm the ink is not visible, greatly improving operator accuracy. This fast, easy to read pen is ideal in production situations for quickly determining if treatment is present. Converting Supply Inc. Poly Test Pens are available in blue and red ink. This pen is also alcohol based and quick drying.

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