

I was reading the description of screen printing on a print consultant's web page and was disappointed but not surprised to read that it was "Silk screen printing used for printing t-shirts and banners." It is this level of ignorance particularly amongst "experts" that is so corrosive for the industry. By industry I do not mean just the screen printing sector but printing as a whole. This is an example of ignorance rather than a deliberate attack. There are other voices who set out to damage the process stating that digital printing will do anything screen printing can achieve. This is simply not so and the people who voice such opinions really should know better. There is no doubt that digital printing technology is continuously evolving and has capabilities that extend outside the remit of screen printing but screen printing is still very widely used in graphics and is crucial to many advanced industrial processes.

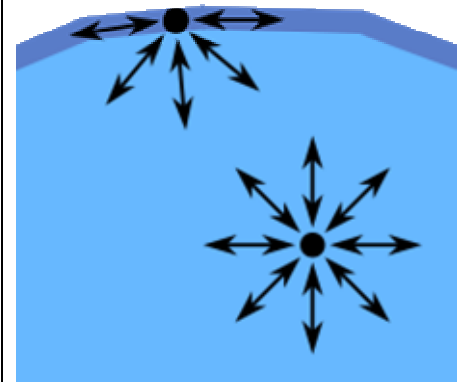
When you compare the processes at a fundamental level they both rely on the same physical properties of liquids and solids and that is surface energy and surface tension. Of course viscosity and shear rate of the ink are key characteristics but without the energy characteristics of a surface structure and form would not exist.

Surface Tension is the molecular force (cohesive force) that is required for a liquid to create a surface.

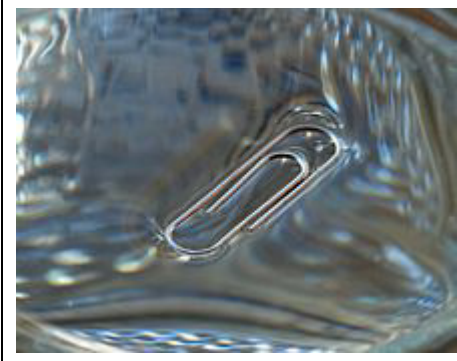
Surface energy may therefore be defined as the excess energy at the surface of a material compared to the bulk. Both screen printing and digital printing rely on the relationship between liquids and solids being suitable for the processes to operate.

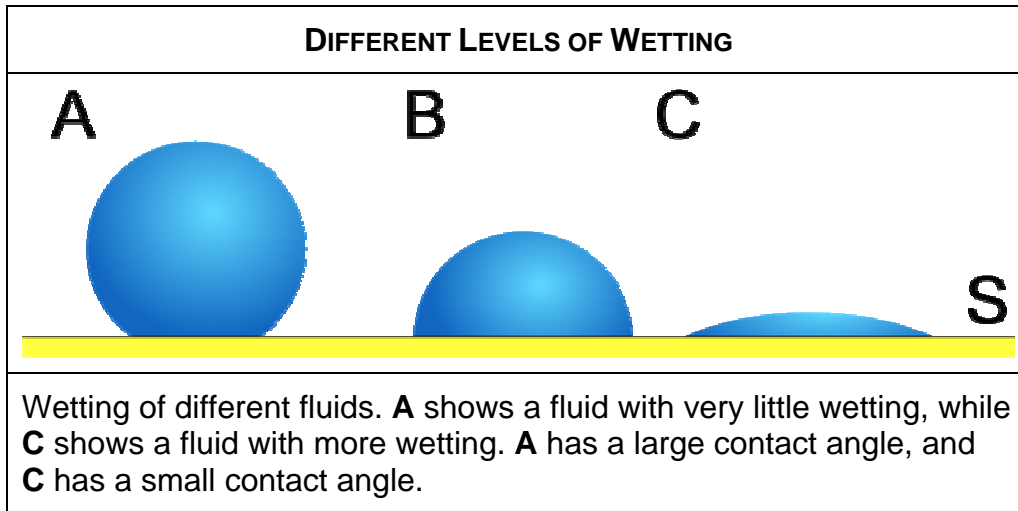
Wetting of a surface occurs when the cohesive forces (surface tension) within a liquid that cause it to form into a ball are overcome by the adhesive forces of a solid.

**THE COHESIVE FORCES
WITHIN A LIQUID**

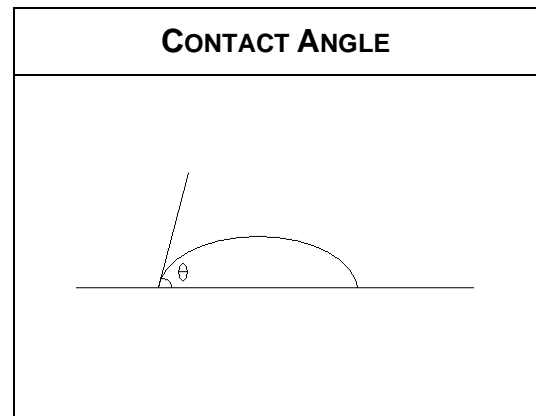


**SURFACE TENSION SUPPORTING
A PAPER CLIP**

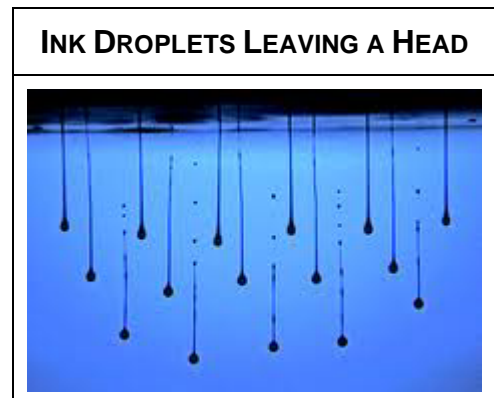




Digital inkjet printing causes a liquid to be expelled through a hole (orifice,) through the air and onto the solid substrate. Once the liquid impacts the solid it should immediately wet the solid surface and spread across the surface by a predictable amount. Surface tension of the ink also determines the conditions of the ink droplet as it leaves the orifice how it wets the substrate and hence spreads on the substrate. The additional effect is what happens to the ink held in the orifice before the next pulse ejects it. If the surface tension is too low it will drip out rather than be ejected. Of course there are other characteristics of the ink that determine its performance during the process but the relationships of surface energy and surface tension are crucial.



With screen printing the mechanism is slightly different but not as different as you may think. Surface tension and surface energy are still vital to its operation. A mesh is a series of orifices. In one square centimetre of 120 threads per inch mesh there are 14161 mesh openings and in one square metre 141,610,000!!



The mesh openings are filled with ink by the action of the flood coater and the squeegee, but the squeegee also brings the ink filled mesh into contact with the substrate by closing the off contact distance. The ink that is in the mesh openings comes into contact with the substrate. If the surface tension of the ink is lower than the surface energy of the substrate it will wet the substrate. In this event there will be adhesive forces between the ink and the substrate that should be sufficient to draw ink out of the mesh openings when the mesh is pulled away by the mesh tension. If the surface

energy of the solid is less than or close to the surface tension of the ink the ink will stay in the mesh opening and not transfer onto the substrate.



This is a simple view on what occurs and there are many factors that influence the mechanism. Unfortunately many people who have been involved in screen printing over the years have not understood the fundamental mechanism and had become “squeegee bashers.” Others such as the group at Swansea University and the team at MacDermid Autotype have done excellent research that has demonstrated the complexity and beauty of the process. With both screen printing and digital printing the characteristics of the ink have to be such that they will flow just enough to move through the process but then stabilise on the substrate. I would recommend that you read the explanations of surface energy and tension given in WIKIPEDIA.

The much criticised ink manufacturers who supply inks for both techniques take great care and apply very sophisticated chemistry to formulating their inks only to have them often treated with disdain by actual users of the ink. In many years experience in working in the industry neither I nor members of my team can recall that the ink was at fault other than the occasional time when it had been supplied slightly off shade. In every other case the wrong ink is used, the ink has deteriorated because it is passed its shelf life or has been incorrectly mixed by the user. In screen printing we have hundreds of different formulations that can be used on a given machine so it is rare that we cannot find a suitable ink. However with digital printing the system is designed to run on one ink formulation for all substrates or we limit the substrates that can be printed with one ink formulation. It amazes me that the market is trying to tell us that there is a one fits all ink formulation. Anybody who claims this is a stranger to the truth. The complexities of ink chemistry using current known technology in themselves prove the point. It may be in a nanotechnology world chemists and physicists will discover a formulation that will facilitate a level molecular attraction to all substrates in all conditions that will mean one ink works in every situation. By that time I will be dust and a multipurpose molecule will be in used for tank armour and toothpaste.

You may remember earlier in the year how I mentioned the success of two British companies, Rolt Marketing Limited and Natgraph Limited. At the end of 2010 their order books are still full with most of their equipment going overseas Alan Shaw of Natgraph has just returned from a very successful trip to Japan, that is the home of one of their key partners Sakuri, and Richard Rolt from India. What both these companies have in



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Printing is Printing Digital and Screen

common is experience and expertise. When it comes to industrial conveyor drying Natgraph are pre-eminent worldwide achieving the double edged accolade of having their equipment and name occasionally copied in less scrupulous markets of the Far East. Fortunately this has not slowed their penetration into this buoyant but competitive market. Richard Rolt is constantly on the lookout to extend the use of reel fed screen printing, he has had particular success in the production of heat applied transfers and bio-medical sensors. Other customers apply materials as diverse as icing sugar and acidic pastes. For this country to succeed as a manufacturing economy both these and other UK companies need to see and increase in demand for their products in the home market. The technologies that they offer are used at the leading edge of manufacturing world wide and that is where UK Limited has to be.