Cork Tech TalkNews

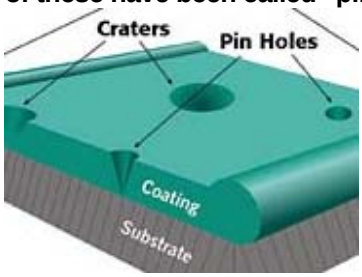
Manufacturers of Waterbase, UV+EB Curable Coatings, Varnishes and Adhesives

10/05

BUBBLES, FOAM & DEFECTS

Air is the culprit. Air introduced into coating, varnish, adhesive or ink fluids, is the bad actor that leads to objectionable defects in wet coated films and in final dry film surfaces.

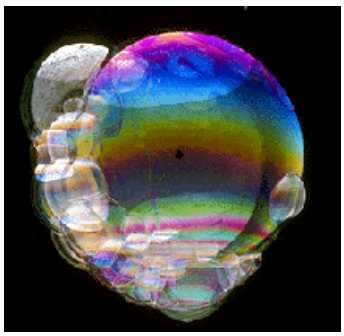
Bubble induced spots are specifically clear round spots, voids in the coating, with no coating in the spot in the dried film. Key to their identity is the fact that they are distinctly round with clear centers. They are said to vary in size from 50 to 1200 microns. The smallest of these have been called "pinholes".



The coating void in the clear center of the spot, or let's call it what it is, a hole or pinhole, is the result of the applied fluid not wetting the substrate. The lack of wetting is the result of a bubble, or small volume of gas trapped in the wet coating film.

Bubble induced defects require the use of low power magnification to assure correct identification as it is easy for the naked eye to confuse various similar defects. Similar defects might be caused by dirt particles, dry coating/ink particles, substrate particles, etc.

The key to avoiding this type of objectionable defect is to understand how bubbles form and how they can be avoided.



It is natural for bubbles or foam to be produced whenever a liquid is being agitated. This can occur during manufacturing or during use in application.

Agitation can bring air into a liquid solution and disperse it as bubbles or foam. Foam results from air being trapped in a fluid where surface tension doesn't allow the air to escape.

In manufacturing it is known that a central agitator used in a vessel that is not baffled, can cause a vortex to form. This vortex when strong enough can suck air into a mixing solution to produce bubbles. The way around this is to use a baffled vessel, or use a tilted, off center, agitator.

Bubbles can also be introduced into a liquid whenever a solution is directed downward from a feed pipe onto the surface of the liquid. If the speed or velocity of the feed pipe liquid is high enough, air is entrained and bubbles are formed. To avoid this problem, it is advised that the feed pipe not direct solution down through the air, but it should be directed against the vessel wall to keep the velocity below that which will entrain air.

There are a variety of ways that bubble-forming air can be introduced into a liquid from a feed line.

1. **When a feed line is empty it is obviously filled with air. Whenever a solution is pumped through an empty feed line the air will be pushed out first.**
2. **Air bubbles can form on an empty pipe or tubing wall when a solution is pumped through it, which will gradually be removed by the flowing solution.**
3. **Any air pockets in an empty pipe or tubing can entrap air, which will be gradually carried by a flowing solution out of the pipe or tubing.**

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Feed line air can be kept from entering liquid in a vessel by directing the incoming feed pipe and its liquid against the vessels sidewall at an angle above the vessels liquid level. If the feed line is located so that it feeds below the surface of liquid in a vessel any line air will be blown through the liquid and form bubbles.

Cork recommends that a coater/applicator return line (low velocity) be plumbed to reach the bottom of the supply container. The return line pipe bottom should be cut at a 45º angle. Ideally the pipe is slotted its entire length with vertically spaced 4" x ¼" wide slots. Returned product will then flow into the drum without splashing and generating foam.

A feed line should have only one high point at which point there should be a bleed valve to evacuate air.

Another major cause of bubbles is leaking pump seals and line connections. These must be checked regularly to avoid air leaks.

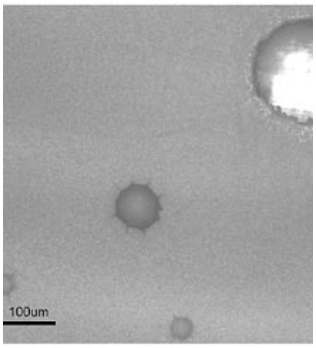
Before a container of liquid coating, varnish, adhesive or ink is brought to the application station it should be stirred well. A "Lightning mixer" or a long stir with a hand paddle can effectively mix aqueous products. UV and EB energy curing products require a thorough mix using a broad blade electric or air-powered mixer.

Low shear pumps are recommended for the transfer of these liquid products. Diaphragm pumps are recommended for aqueous products. Diaphragm, centrifugal or peristaltic pumps are recommended for UV/EB energy curing products to avoid high shear, which can initiate undesirable premature polymerization. Do not use gear or piston pumps.

A supply pump should only be run at a rate that satisfies application equipment demand and does not recirculate coating excessively. The return line must not be allowed to suck and pump air into the product supply. The product level must never be allowed to drop too low.

Take care to assure that detergent/soap wash-up solutions are thoroughly rinsed from equipment and plumbing in order to avoid the production of foam during subsequent use.

The product application system itself must also be watched. Bubbles can be formed from entrained air during a coating application operation. In any application operation the moving substrate, sheet or web, carries a thin boundary layer of air toward the applied fluid (product) bead. This layer of air is dismissed at low application speeds as the substrate meets the product bead, however, at higher speeds the layer of air can form bubbles. These bubbles of air can then form the dreaded pinhole defects as the wet film is dried.



Bubbles and foam can also be generated by the cylinders and other moving parts of the coating/application apparatus in contact with the liquid product. Care must be taken in running the application equipment to manufacturers specifications.

While coating and ink manufacturers routinely incorporate "defoamers" or anti-foams into their formulations to change the products surface tension, which allows bubbles or foam to dissipate, users must still take care.

The key to air bubbles, foam and pinhole defects in dry product films, is to avoid the introduction of air into the wet liquid product both before and during application.

LOOK TO CORK!

Whatever your product requirements-
Whatever your processes-

LOOK TO CORK!

For Corkote Aqueous, and Corkure UV and EB coatings, varnishes and adhesives.