

## Surface Defects: Reasons and Possible Preventions

### Surface Tension:

Very often, surface defects occur during and after application of paint. These defects have a negative influence on both the optical properties of the coating and its protecting quality.

Typical defects are shown below:

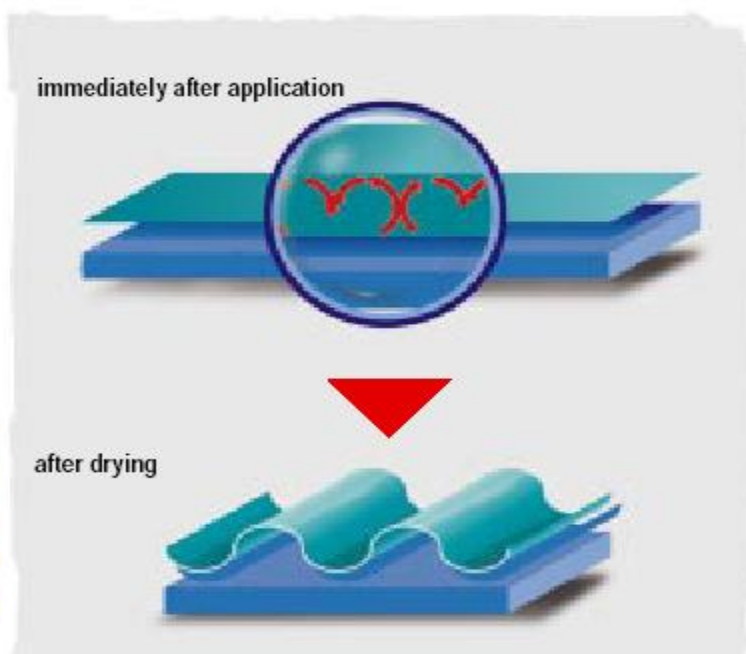
- Formation of Benard cells
- Air Draft sensitivity.
- Crater formation

If considerable surface tension differences must be equilibrated (evened out), Polysiloxanes are used. They can depending on their chemical structure strongly reduce the surface tension of the liquid paint. Therefore they are preferably used for improving the substrate wetting and as anti-cratering additives.

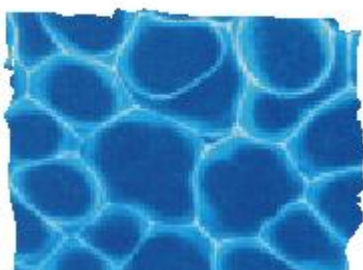
One very significant parameter for all these defects is the **surface tension** of the involved materials. More specifically, the surface tension differences should be considered, which are the actual reasons for these surface defects. The source of such surface tension differences can be solvent evaporation or from external causes (overspray, dust particles, or contamination of the substrate). To prevent surface tension defects, additives are used. They influence the surface tension of the paint and or minimize the surface tension differences.

**Air-draft sensitivity:** Dependent upon the drying conditions and also upon the particular features of the solvent mixture, the drying of the resin solution can occasionally become so strongly influenced by surface defects that the entire top surface of the film is completely disrupted. This extreme effect is called "air-draft sensitivity" and is generally caused by air-draft conditions that place extreme stress on the top layers of the coating. It's especially well known in furniture coatings. This leads to the formation of specialized macroscopically visible cell structures (Bernard Cells). Differences in density, temperature, and especially surface tension are the driving force behind this cell formation process. Many different surface defects can be traced back to Bernard Cells, flooding & floating, flow, air-draft sensitivity.

### ► Generation of surface structures

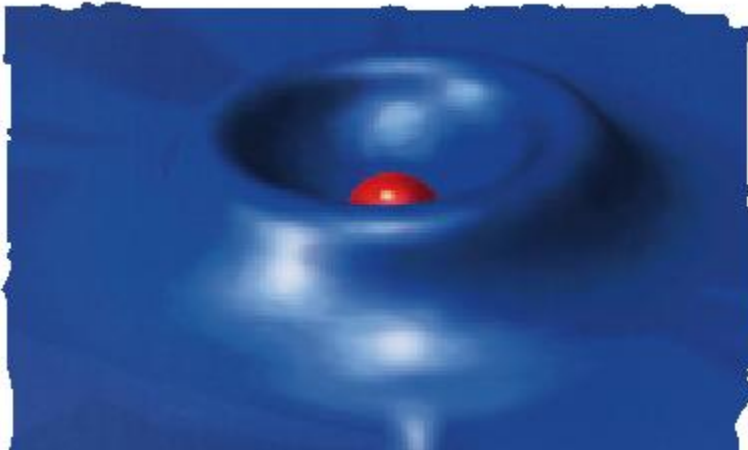


### ► Bénard cells



**Anti-catering:** The causes for crater formation can be very diverse. Craters may be created, for example, by overspray falling into a freshly sprayed paint layer (a layer that is still mobile). Fine spray droplets from the overspray can lead to craters when the surface tension of such droplets is lower than the surface tension of the still mobile paint surface. Surface tension differences of 1-2 mN/m (Dynes/cm) are sufficient to cause spreading of the droplets, thus leading to craters. In cases where the surface tension of both materials are the same, or if the spray droplets have a higher surface tension; then there is no spreading action of the droplets and consequently no crater formation. Small dust particles, which fall into the still mobile paint layer, can also have the same effect as overspray droplets. Craters can also originate from unclean or contaminated substrates for example, from fingerprints on panels). When such contaminations display lower surface tension, they will lead to craters whenever subsequent layers of paint are applied. One can denote the occurrence of such effects as a special case of improper substrate wetting. Through proper utilization of the silicone additive, surface tension is lowered and accordingly the paint becomes visibly less susceptible to disturbances or disruptions from the outside environment (overspray, dust particles, etc.), from the substrate (contamination), or even from the film itself (gelled particles). As a result of the usage of silicone additives, the application of the coating is safer. In these cases the most effective surface tension lowering agents are required.

#### ► Craters



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