

Hydrophobic vs. Hydrophilic Coatings

Understanding the advantages, characteristics, and functions of a hydrophobic coating vs. a hydrophilic coating allows design engineers to make the right choice for their applications. “Hydrophobic” and “hydrophilic” are easy to get confused with one another and it is important to learn the origins of these words before even beginning to point out the similarities and differences. “Phobic invokes the Greek word for fear, so a hydrophobic coating “fears” water, and does not interact with it well. It may even repel the water. “Philic” invokes the Greek word for love, therefore a hydrophilic coating is “water-loving”. It readily interacts with water.

Functional Differences

The main method for distinguishing between hydrophobic and hydrophilic surfaces is contact angle. This refers to the angle that a droplet of fluid, usually water, makes at the point of contact with a rigid surface. For hydrophobic coatings, this angle is always greater than 90 degrees, and it can be as high as 150 degrees (Figure 1-1). Hydrophilic coatings always have contact angles less than 90 degrees and usually less than 50 degrees (Figure 1-2).

Although both types of coatings have relatively low coefficients of friction, hydrophilic coatings tend to be more lubricious. Some of the best hydrophobic coatings offer coefficients of friction in the range of approximately 0.15 to 0.3. On the other hand, hydrophilic coatings that claim to be exceptionally lubricious have coefficients of friction in the range of 0.005 to 0.2.

One area where both types of coatings are similar is how they are affected by cross-linking. Generally, there is an inverse relationship between lubricity and degree of cross-linking: the more cross-linked a material is, the less likely it is to be slippery. Cross-linking also affects basic polymeric properties such as glass transition temperature, stiffness, and solubility. These factors,

Figure 1-1

Hydrophobic

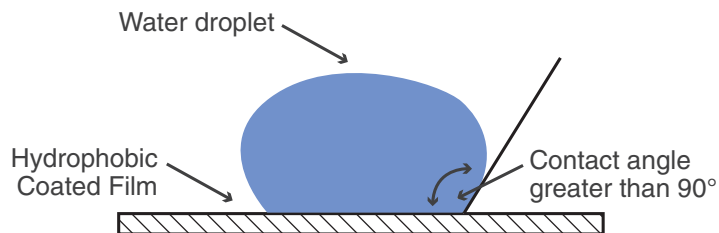
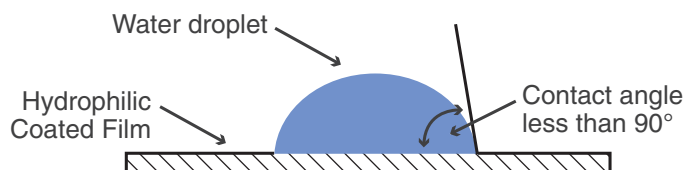


Figure 1-2

Hydrophilic



Hydrophobic vs. Hydrophilic Coatings - continued

together with polar interactions, all relate to how a surface interacts with water because they control how easily a material absorbs or repels water. Physically, materials that are cross-linked also have higher durability.

Applications

There are some clear cases where one type of coating is required over another. Project teams will need to understand their device requirements with regard to water barriers and optics. A primary purpose of hydrophobic coatings is to act as a barrier against water. If a device must be sealed to prevent moisture from getting inside, hydrophobic coatings will work to repel water from the device's surface and act as a sealant over areas where water can penetrate to the interior.

Hydrophilic coatings do the opposite. They absorb water, and most of them are comprised of more than 90% water when wet. With hydrophilic coatings, continuous diffusion of water across the thickness of these coatings occurs. If this would be detrimental to the device, a hydrophilic coating is not recommended.

Tekra's CleanView Coating

Tekra's hydrophobic coating called CleanView, provides an easy to clean surface when applied to a substrate. Based on Tekra test method TM 10.118, this hydrophobic coating has a contact angle of 110 degrees, making it difficult for substances to adhere to it. The low surface energy of this coating serves as a repellent to oil and water to prevent wetting out. CleanView can be applied to polyester or polycarbonate film to provide easy removal of fingerprints, oils, dust, and other contaminants from the coated surface.

CleanView is cross-linked the same as Tekra's standard hardcoats, providing the same abrasion resistance, pencil hardness, and chemical resistance as Tekra's Marnot® hardcoat films. Consider CleanView for touch screens, household appliances, and membrane touch switch applications where fingerprints would otherwise be a distraction.

