



## Surface Free Energy



Surface free energy, usually measured in “dynes/unit area,” is a fundamental property of solid surfaces, and is closely related to the surface tension of liquids. Molecules on the very outer surface of a material have an electron imbalance that causes higher surface energy. These molecules try to reduce this free energy by interacting with molecules of adjacent materials. This imbalance of energy is the reason liquids form spherical droplets, and is a very important property to consider when coating adhesives. In order to wet the surface evenly, liquid adhesive must have a lower surface tension than the surface free energy of the material being coated.

For example, a liquid adhesive having a surface tension of 72 dynes/cm<sup>2</sup> will not wet a polyethylene surface having a surface free energy of 33 dynes/cm<sup>2</sup>, and a poor bond will result. Surfactants and thickeners may be added to the adhesive to reduce its surface tension. It may also be necessary to add chemicals to the adhesive to cause the solids of the adhesive to wet material being coated. In addition, heat may be required to melt the adhesive to assure intimate molecular contact to the material being coated.

The adherend may also be treated to increase its surface free energy by flame, corona discharge, laser or plasma treatment of the surface. These also form polar, chemically reactive functional groups, which enhance the adhesive bond. Understanding surfaces, cleanliness, and surface energetics is an important aspect of understanding adhesive bonding, formulation, and using adhesives to produce a uniform, predictable product for the consumer.