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## Exponential Business and Technologies Company

### Water Wettability of Materials Quantified by Contact Angles

Water-resistant products are growing in the market, especially in the cookware and textile industrial segments. How do you determine your product's water repellency or hydrophobicity? A common way to represent a product's tendency to repel water from its surface is to determine the contact angle produced by water on the surface. Based on the results of a contact angle test, the attraction or repulsion of water by the surface, also known as wettability of water on the surface or hydrophilicity and hydrophobicity, can be quantified and determined.

A material is considered hydrophilic, or water attracting, if the contact angle made by water on the material surface is less than  $90^\circ$ . This means that the water will wet the surface of the material more easily. A material is considered hydrophobic, or water repelling, if the contact angle made by water on the material surface is more than  $90^\circ$ . This means that the surface of the material is not very wettable.

In this application note, water contact angles were measured for several common household materials: stainless steel, PTFE, polyurethane leather-substitute and rayon fabric, in order to determine their water wettability.

One of the most marketable features a household product can possess is an easy-to-clean surface. This is seen in the cookware industry where polytetrafluoroethylene (PTFE), commonly referred to as Teflon™, is used to make a piece of cookware "non-stick". PTFE is added as a thin layer onto the surface of a metal substrate. This layer gains its functionality from the hydrophobicity of the PTFE material. Figure 1 shows recorded images and contact angle values of water on stainless steel and PTFE, respectively.

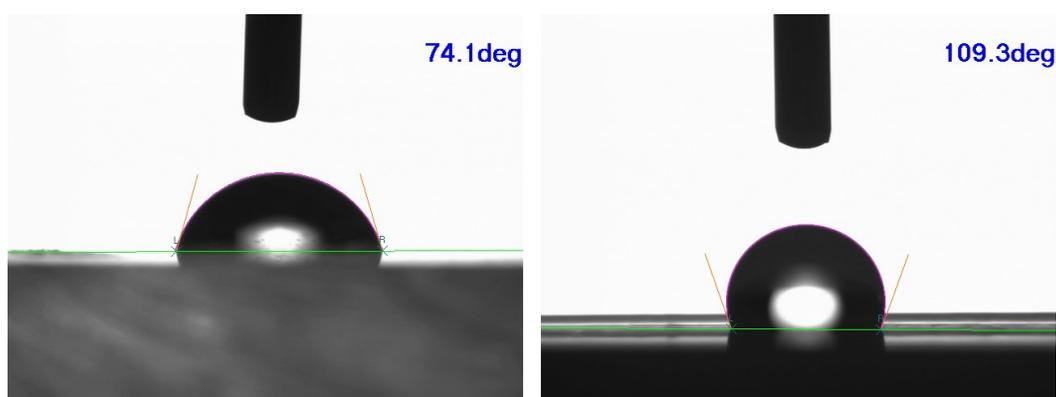


Figure 1. Contact angle between water and stainless steel (left), and between water and PTFE (right).



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As can be seen from Figure 1, the contact angle of water on stainless steel is  $74.1^\circ$ , and the contact angle of water on PTFE is  $109.3^\circ$ . Due to these results, it can be said that the stainless steel is hydrophilic and PTFE is hydrophobic.

In the textile industry, it is desirable for clothing to repel water or sweat. Companies try to ensure that their weather-resistant clothing repels water so that it will allow rain and snow to roll off or slide down rapidly, not to dampen the product. Other companies are using hydrophobic materials to repel sweat so that in the hotter months the garment will be less likely to be wetted by perspiration. Figure 2 shows recorded images and contact angle values of water on polyurethane leather-substitute and rayon textiles, respectively.

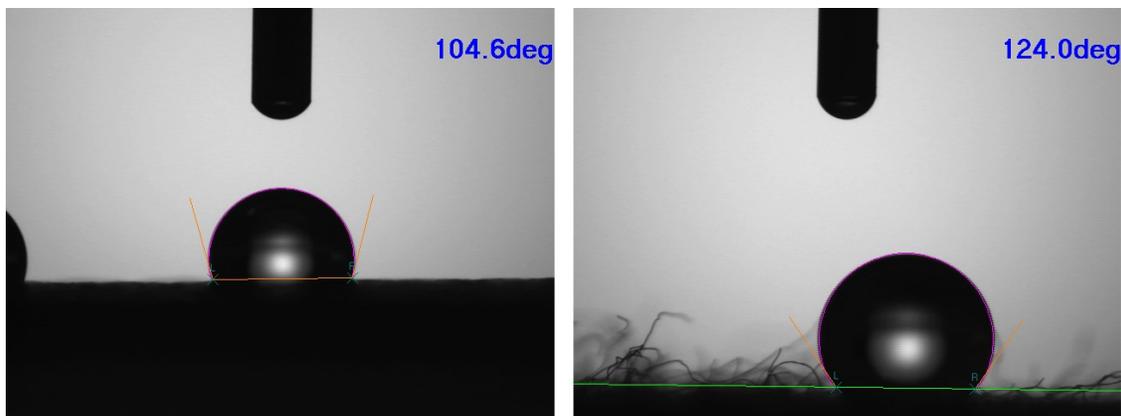


Figure 2. Contact angle between water and polyurethane leather-substitute (left) and between water and rayon fabric (right).

As shown in Figure 2, under ambient laboratory conditions, the contact angle of water on polyurethane leather-substitute is  $104.6^\circ$ , and the contact angle of water on rayon fabric is  $124.0^\circ$ . Based on these results, it is clear although both polyurethane leather-substitute and rayon fabric are hydrophobic, the latter will likely provide better performance with regards to water-resistance.