

Printability and Micro-roughness

One of the most basic properties of a substrate that is used to estimate how effectively it can be printed, is the smoothness of the surface. There are numerous commercial instruments available to the paper industry for measuring the smoothness or “roughness” of paper. Most of them rely on testing the rate of air leakage when a level chamber is clamped against the sheet surface. A rough sheet will not effectively seal the chamber. Consequently, air leakage rate through the unsealed crevices will be high. A smoother or less rough sheet will have a lower air leakage rate. All air-leak devices are able to distinguish extremely rough paper from smooth paper. This measurement is called “macro-roughness”.

Instruments that only measure macro-roughness do not reliably predict how well a substrate will print. There are a number of factors that explain this. One key factor is that these instruments lack the sensitivity to measure on a scale small enough to be relevant to printing. For example, a half-tone dot can range from 20 to 60 microns (0.0008 to 0.002 inches) in diameter. Various air-leak device measurements can span widths ranging from 51 to 13,500 microns (0.002 to 0.53 inches). Depending on the air-leak method this is a breadth 2 to 675 times the size of a half-tone dot! Therefore, it is easy to see why some of these devices are poor predictors of print quality.

Smurfit-Stone’s research has shown that there is a commercial instrument that can accurately predict how well a liner will print. Instead of measuring air leakage, this device mechanically traces the surface of the paper using a small stylus. A level plate or platen is laid against the surface of the sheet. Contained within the platen, a stationary, floating stylus traces the paper’s surface as it is gently moved past the stylus. The device takes several hundred readings with sensitivity in the millionths of an inch! A profile of the paper surface is drawn and statistical information is noted. The most important value is the variability in the amount of up and down movement of the stylus as it passes over the sheet. A rough paper will exhibit more vertical travel than a smooth paper. This is much like comparing a walk through the mountains to a walk across rolling hills or the plains. This index is referred to as **micro-roughness**.

Data shows that lower micro-roughness numbers translate into higher ink densities and lower dot gains. In addition, the lower the micro-roughness number, the higher the gloss of unprinted and printed sheets due to less light scattering by the sheet’s surface. The table below shows the micro-roughness of some everyday materials and liner products on the market today.

Micro-roughness Indices of Various Products*

	<i>Micro-roughness microdeviations</i>
<i>Corrugating Medium</i>	<i>350 & up</i>
<i>Kraft Liner</i>	<i>150-300</i>
<i>Glass</i>	<i>0.9</i>
<i>Smurfit-Stone High Hold Out Bleached Liner</i>	<i>5-10</i>
<i>Smurfit-Stone Regular Hold Out Bleached Liner</i>	<i>15-20</i>
<i>Competitor A’s Bleached Liner</i>	<i>20-25</i>
<i>Competitor B’s Bleached Liner</i>	<i>50-60</i>
<i>Smurfit-Stone Premium White Top</i>	<i>30-40</i>
<i>Smurfit-Stone White Top</i>	<i>50-75</i>
<i>Competitor C’s White Top</i>	<i>75-100</i>
<i>Competitor D’s White Top</i>	<i>90-130</i>

* Values are an average from a limited number of samples.

Low micro-roughness means the press operator will have better control printing half-tone dots and use less ink to print solids since there are shallower valleys that have to be filled with ink. Consequently, graphics will be sharper.

Presently, the paper industry is developing a standard test method for measuring the micro-roughness of paper. This may eventually lead paper manufacturers to set micro-roughness specifications in addition to conventional air-leak roughness specifications.

If you would like more information on micro-roughness or other technical topics, contact your Smurfit-Stone Sales Manager or call us toll free at 1-877-785-7835 or by e-mail at paperwise@smurfit.com.