SAMCO

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Supplier of Quality Force Measuring & Weighing Equipment Since 1932

APPLICATION NOTE

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COF Testing

Coefficient Of Friction (COF) is the ratio of the frictional force to the force (gravitational in this case) of two surfaces of contact. It is used to determine the relative difficulty of sliding one surface against another. With plastic films generally the two surfaces are samples of the film.

There are various test methods written including: ASTM D 4518, ASTM 1894, TAPPI T 549, TAPPI T 816, and ISO 8295 prescribing the parameters and calculations for COF. There are two methods generally used to measure COF, the inclined plane and the horizontal plane system.

The horizontal plane system uses a sled, usually 200 grams of mass and 63.5 mm square with a rubber coated surface, that is moved a prescribed rate relative to the specimen while resting on its surface opposite the side of interest. On some horizontal systems the sled is held stationary and the test bed is moved while on others the sled is moved while the test bed is held stationary. There are also attachments for vertical force testers that pull a sled along a horizontal test table via a pulling cable that is routed through a 90 degree turning block and attached to a vertically moving force measuring device. Each of these methods produces similar results and provide for a simple calculation of dividing the resulting force by the mass to calculate COF in one test operation.

The inclined plane system generally uses a different mass and size sled than the horizontal plane. With the inclined plane system the test bed is move from horizontal to vertical at a prescribed rate and stopped when the sled begins to slide to obtain the angle for the static COF calculation. The tester is reset and stopped again when the sled slides the length of the slide and the test bed is stopped to obtain the angle for the kinetic COF calculation. The trigonometric tangent of the mean angle is calculated and the resultant is the COF value. In addition having a more complex calculation, the inclined plane system requires two test runs to obtain static and kinetic COF.

There are two areas of interest when measuring Coefficient Of Friction, static COF and kinetic COF. Static coefficient of friction is the friction detected at initial start of the test to move the specimen from rest. In practice this is usually the higher force (unless it is a very low friction surface where static and kinetic COF can be equal); therefore, the peak pulling (tension) force reading is static COF. The formula is as follows:

$$\mu_s = A_s / B$$

where:

μ_s = static coefficient of friction
A_s = initial motion force reading, g
B = sled weight, 200g

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Kinetic coefficient of friction is an average of the force required to slide a test specimen a specific distance, usually 6 inches, over a specified period of time, usually 60 seconds, divided by 200. It should be noted that the static force, that is, the force required to move the specimen from rest, is not included in the average. Usually this is accomplished by ignoring the first few milliseconds of the test before beginning the averaging process. The formula for kinetic coefficient of friction is as follows:

$$\mu_k = A_k / B$$

where:

μ_k = Kinetic coefficient of friction
A_k = average motion force reading obtained during uniform sliding of the film surfaces, g
B = sled weight, 200g

Which ever method is used, the resulting calculation is dimensionless and can only be obtained through actual measurement of materials. S. A. Meier Co. of Milwaukee, Inc offers a full range of COF test systems designed to meet you needs. Contact us for more information.