Coefficient of Friction of Paper Used in a Copy Machine

Application Report

Introduction

A manufacturer of copy paper needs to investigate the cause of copy machine failure as a result of frequent paper jams. A Coefficient of Friction (COF) test was recommended to measure the static and kinetic coefficients of friction between two sheets of paper. The COF measurement is a ratio that describes material surface roughness. For example, ice has a coefficient of friction close to zero because it is essentially frictionless. As the COF ratio increases closer to 1, the material surface roughness increases. Because no specific testing standard outlines a method for testing this type of material, ASTM D 1894 "Standard Test Method for Static and Kinetic Coefficient of Friction of Plastic Film and Sheeting" was followed.

Test Configuration

Frame: 3345
Load cell: 2 lbf
Fixtures: COF fixture
Test speed: 5.0 in/min
End of test: Peel extension of 3 inches

From one ream of paper, a single sheet was carefully taped to the base of the friction fixture and another sheet was wrapped around the sled. It was important to make these surfaces as smooth as possible. Each test was run using new sheets of paper to define the mean static and kinetic COF values for each ream. The results from two different reams were compared.

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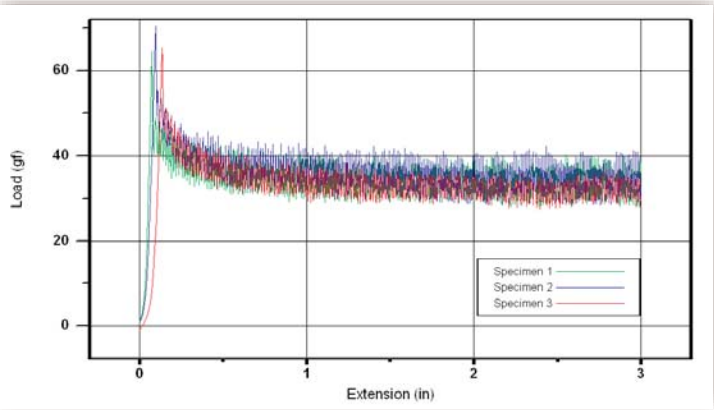
Figure 1:
Test configuration for coefficient of friction test between two sheets of copy paper.

Results



▲
Figure 2:
Load vs. extension results for three specimens tested in Sample #1.

Specimen #	Static COF	Kinetic COF
1	0.3231	0.174
2	0.3524	0.1808
3	0.3268	0.1687
Mean	0.3341	0.1745
S.D	0.0159	0.0061

▲
Table 1:
Static and kinetic COF results for three specimens in Sample #1.

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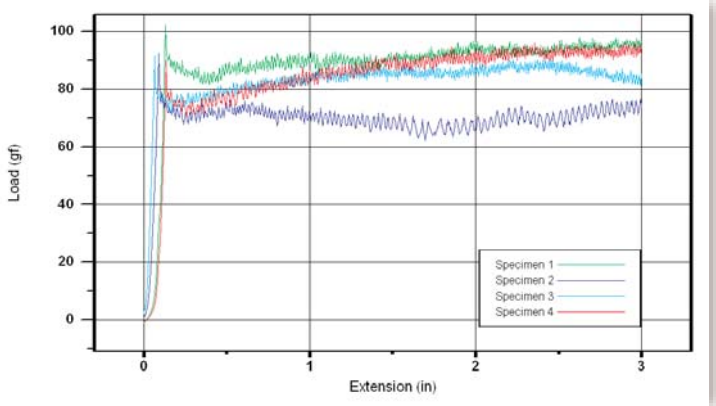

Figure 3:
Load vs. extension results for four specimens tested in Sample #2.

Specimen #	Static COF	Kinetic COF
1	0.5124	0.4552
2	0.4631	0.3514
3	0.4588	0.4198
4	0.4501	0.4341
Mean	0.4573	0.4018
S.D	0.0066	0.0442

Table 2:
Static and kinetic COF results for four specimens in Sample #2.

Discussion

The static coefficient of friction is measured at the initial peak load and is a function of the load required to overcome the force of friction and initiate movement. The kinetic coefficient of friction is the mean load value measured over a specific value of sled displacement. It can be seen that the static COF value is much greater than kinetic COF in Sample #1, as compared with Sample #2, where these values are much closer in value. The consistency of results acquired in Sample #1 as compared with a higher variability in Sample #2 may provide insight into different manufacturing processes used. In conclusion, this type of test was effective in distinguishing between the surface coefficient of friction in two paper samples.

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