Abrasion Resistance Testing

1. Introduction

Seven batches of plates were received from Frank Britt for abrasion resistance testing. The main purpose of the testing is to characterize the wear resistance of the ceramic coating on the FRP substrate. All of the testing was conducted based on ASTM D4060-01.

2. Testing Procedure

A Taber abraser, shown in Figure 1, was used for the testing. The plates were weighed before actual testing using a 4-digit balance, then placed on the rotating base and fixed to the machine. A load of 1000 g was used during the testing. Vacuum suction was set to 95% to clean the particles coming off from the wear testing. Plates were weighed again after the testing.

Abrasive wheel CS-17 was used during all stages of the test. This type of wheel is within the medium to coarse type of abrasive media, and is known to produce harsher results like those associated with traffic or underfoot wear. CS-17 wheels are used in the qualification of anodized aluminum, ceramics, plastics and enamels.   The wheel was refaced at the start of each test using the S-11 re-facing disks for 50 cycles at a 70% suction level according to the ASTM.
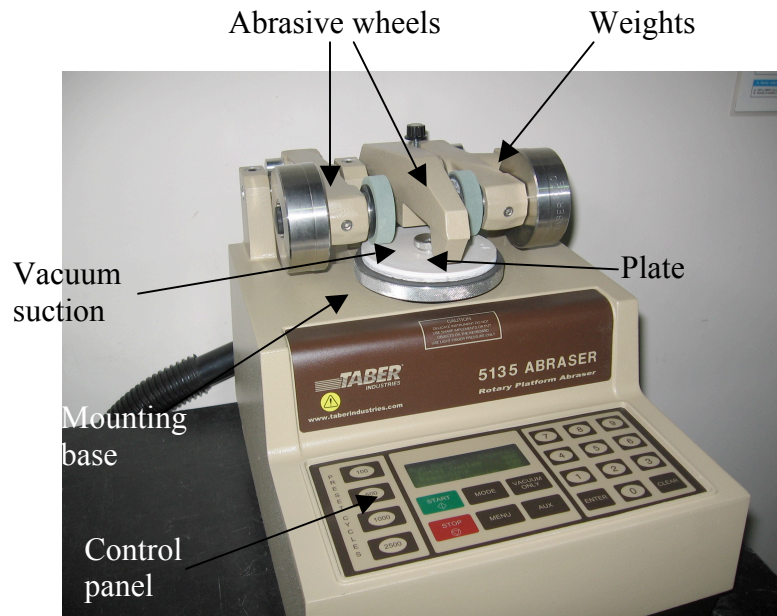

Figure 1. Taber abraser with a plate mounted.

The parameters used for the testing are listed in Table 1.

Table 1. Parameter used during the wear testing

Load	Vacuum suction	Vacuum distance to the plate	Rotation speed
1000 g	95%	0.25"	60 rpm

3. Results

Only four batches of plates were tested due to the thickness limitation of the Taber abraser (maximum plate thickness is ¼"). Figure 2a and 2b shows a plate before and after the wear testing. Table 2 lists the test results, including weight before and after the testing, weight loss and Taber wear index for these plates.

It is shown that C1-CL plates have the lowest weight loss and Taber wear index after 400 cycles at 1000g loading and 60 rpm rotation speed among the 4 batches of plates tested.
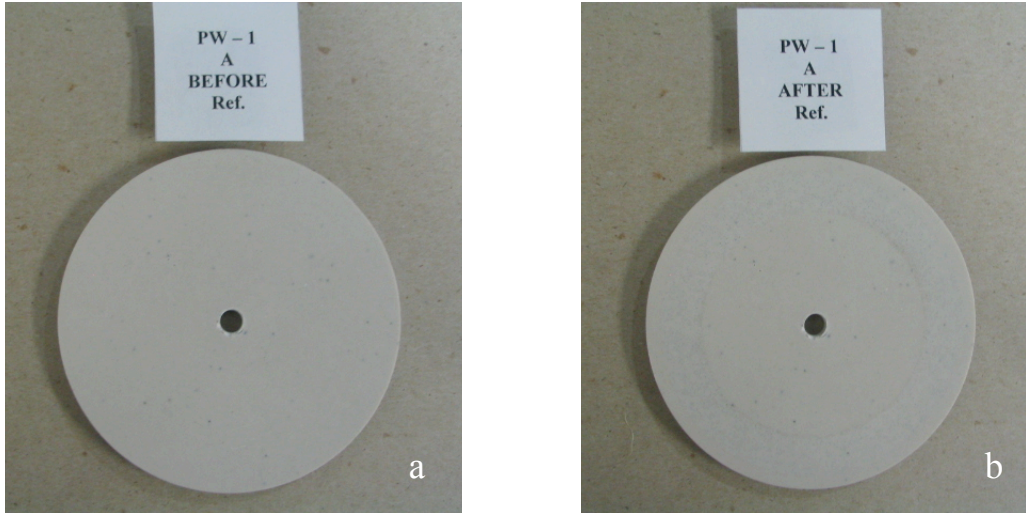

Figure 2. A plate before (a) and after (b) the wear testing.

Table 2. Results from the wear testing.

Specimen	Cycles	Weight Before (g)	Weight After (g)	weight loss (mg)	Taber Wear #
PW-1-A	400	65.2161	65.1637	52.40	131
PW-1-B	400	73.9953	73.9498	45.50	113.75
PW-1-C	400	71.3796	71.3126	67.00	167.5
C1-CL-A	400	59.9972	59.9765	20.70	51.75
C1-CL-B	400	66.7528	66.7321	20.70	51.75
C1-CL-C	400	75.8692	75.8431	26.10	65.25
AR-1-CL-A	400	75.0214	74.9777	43.70	109.25
AR-1-CL-B	400	83.4633	83.4121	51.20	128
AR-1-A	400	84.9216	84.8742	47.40	118.5
AR-1-B	400	137.9173	137.8878	29.50	73.75

Conclusions:

The CL-CL family of specimens exhibited the lowest wear characteristics. The surface characteristics of the specimens did not change notably; however profileometry and microscopy will provide additional insight into the same.