

# Memo

**To:** Dr. Frank Buckel  
**From:** Alan Jaenecke  
**Date:** October 27, 2011  
**Re:** IGPG Taber Round Robin

Dr. Buckel,

The below list summarizes the potential sources of variation found in the round robin on plastic substrates that you identified in your email dated October 18:

- ◆ Different test procedure used
  - refacing medium - ST-11 refacing stone (every test lab used the ST 11 refacing stone)
  - vacuum nozzle orifice size (8 test labs used 11mm and 2 used the original 8mm)
  - vacuum nozzle gap (was not requested to document but 7 reported the value between 0.8-1.6mm as requested in ASTM D1044)
  - using an anti-static brush after refacing the wheels (was not requested to document)
- ◆ Calibration and age of the instrument (including suction force)
- ◆ Consistency of the CS-10F wheels
  - two wheel lots generating high values for plastic substrates have been tested by Taber (one lot was the source for the high values, the other lot was OK)
- ◆ Haze measurement (haze cross check for PC samples done by PC sample manufacturer confirm that there is no significant deviation in haze measurement between the participating test labs)
- ◆ Sample inhomogeneity (since the repeatability is good compared to the reproducibility the samples are probably not the source)

There are two potential issues with the ST-11 refacing stone that should be mentioned.

- 1) The original duplex ST-11 refacing stones included different formulations on the opposite sides. One was an 80 grit (coarse) while the opposite was a 180 grit (fine). These were differentiated by color or by a product marking. In June 2010, Taber redesigned the product so that both sides are 180 grit (fine).
- 2) There is a useful life to the ST-11 refacing stone of 400 refacings or 10,000 cycles per side. Taber supplies tracking sheets to monitor usage. Earlier versions of ASTM D1044 stated 'discard the ST-11 refacing stone when grooves or ridges first become evident'. Unfortunately, this was too subjective.

The test load reference has created confusion with previous methods and should also be mentioned as a potential source of variation. Because the wheels act independent of each other, the load reference is "per wheel". Therefore, a reference of 500g load requires the operator to attach the weights marked 500g to both the right and left abraser arms.

Similarly, the test load used is another source of variation that has not previously been considered. For the IGPG Taber Round Robin, I believe only one lab reported which load they used. Section 9.1.2 of ASTM D1044-08 describes the standardization of abrading wheels and states "Select the load to be used and affix it to the abraser. If no load is specified, use a load of 500 gf (per wheel)". Section 10.4 of the procedure reiterates information and recommends an abrasion of 100 cycles unless otherwise specified. If a load of 1000g per wheel was used, the resulting haze values are typically higher than if a load of 500g per wheel was used.

Only four participating labs reported that samples were conditioned 40 or more hours. Section 8.1 of ASTM D1044-08 requires test specimens to be conditioned at  $23^{\circ} \pm 2^{\circ}$  and  $50 \pm 5\%$  relative humidity for not less than 40 h prior to test. In addition, tests should be performed in a conditioned laboratory in the same conditions. Unfortunately I do not have any data to support what the influence is on test samples that were not conditioned properly.

My initial report (dated June 6, 2011) mentioned section 5.5 of ASTM D1044-08 requiring the use of a suitable holder to position the specimen on the hazement so the light beam is centered in the abraded track. Because participating labs did not report the use of a Taber Holder, I originally thought this was a source of variation. However, your comment that the haze meter cross check did not show any significant deviation, this does not appear to be a source of variation.