Spring 2009 Paint Test

Paint Test Repeat

In the Fall of 2008, the Solar Ovens team performed a test aimed at discovering an appropriate and effective means of preventing paint from peeling off the steel framing of the box ovens. While this test led to interesting and useful results, it was done with a U.S. variety of oil paint that differs slightly from the paint used by las Mujeres Solares. Having procured a sample of the Nicaraguan paint, the Spring 2009 Solar Ovens team repeated the paint test.
The procedure from the Fall 2008 test was followed as closely as possible; please see the Fall 2008 Paint Test for exact details. The differences between the Spring 2009 paint test and that of the Fall 2008 were:

1. Use of Nicaraguan paint in place of U.S. oil paint
2. Use of ammonia in place of baking soda as neutralizing agent
3. Use of different roll of duct tape (possible variation in adhesive properties)

In addition to corroborating the Fall 2008 results, the Spring 2009 team sought to determine the effect of hand oils on paint adhesion. To do the hand oil tests, we prepared 8" by 1" columns of the surface with one of the pretreatments considered (control, sanding, and phosphoric acid) as described in the Fall 2008 procedure, and then rubbed our fingers (neither recently washed nor particularly oily) on each column for approximately two minutes.
Results of the Fall 2008 and Spring 2009 paint tests are summarized below. The error bars on both charts represent 95% confidence intervals.

results08.jpg

results09.jpg

Table 1 compares the results of the 2008 and 2009 paint tests. Here we define adhesion, a, as

a = 1 - Nremoved/Ntotal

where Nremoved is the number of squares removed, and Ntotal is the total number of squares in our grid (64 in this experiment).

Comparison of paint test results

Pretreatment	2008 Adhesion	2009 Adhesion	Variation
Control	76.6%	61.8%	14.7%
Soap	89.1%	73.7%	15.3%
Vinegar	95.0%	69.3%	25.7%
Sand & Vinegar	97.3%	82.2%	15.1%
Sand & Soap	97.5%	86.7%	10.8%
Sand	99.4%	86.9%	12.5%
Sand & Phosphoric Acid	99.8%	98.5%	1.2%
Phosphoric Acid	100.0%	95.4%	4.6%

It can be seen that the general trends of the 2008 test were reproduced: phosphoric acid performed the best, with no statistically significant difference between the trials with and without sanding. Although sanding did not perform as well in the 2009 experiment as it did in 2008, it was still the second best pretreatment with an adhesion 25% better than the control group.

It is worth noting that all pretreatments in the 2009 experiment displayed significantly poorer adhesion values than they did in 2008, with an average downward shift in adhesion of 12.5%. This is likely due to the change in tape; the 2009 duct tape, of which we ran out, was noticeably stickier than its 2008 counterpart was.

Finally, the experiment was inconclusive as to the result of hand oil on adhesion. In the case of no pretreatment, hand oil had no discernable impact on adhesion. In the case of phosphoric acid, hand oil increased the adhesion by three percent. In the case of sanding, hand oil decreased the adhesion by one percent. None of these differences are statistically significant; however, as they all lie well within the confidence intervals of their respective treatments. It appears that a more sensitive test would have to be developed to detect the effect of hand oil on paint adhesion.