

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2001
 DateRun: 08/27/2001
 Experimenters: Jason Marshall
 ClientType: Electronics Manufacturer
 ProjectNumber: Project #1
 Substrates: Ceramics
 PartType: Coupon
 Contaminants: Adhesive
 Cleaning Methods: Immersion/Soak
 Analytical Methods: Gravimetric

Purpose: Evaluating additional cleaners for removal of reed wax.

Experimental Procedure: Four cleaners were selected based on the results from the successful previous trial. A fifth cleaner was added based on client request. All five solutions were used at full strength. Four products were heated to 140 F on a hot plate and the fifth, Uni-Clear, was heated to 100F in a heated water bath (due to its low flash point of 140 F). Fifteen preweighed coupons were coated with the supplied Reed wax. The wax was heated with a hot air gun and a moderate layer was added to the coupon. These coupons were then allowed to cool to room temperature and weighed again. Three coupons were immersed in each of the cleaners. Observations were made at 5, 10, 15, 20, 30 and 45 minutes. After the final observation, the coupons were rinsed in DI water and dried using air blow off. Coupons were then weighed a final time and percent efficiencies were calculated for each cleaner.

Results: Of the five products evaluated, only two removed over 85% of the wax from the coupons. The Buckeye Shopmaster RC removed 88% and the Universal Photonics Uni-Clear removed 99.97%. The other three removed less than 5% of the wax. Table 1 lists the efficiencies for each cleaner and coupon.

Table 1. Cleaning Efficiencies

| | Shopmaster | Safe Strip | DBE-4 | 590 S | Uni-Clear |
|----------|------------|------------|-------|-------|-----------|
| Coupon 1 | 94.71 | 2.18 | 1.08 | 1.36 | 100.00 |
| Coupon 2 | 91.48 | 1.38 | -2.30 | 2.62 | 100.02 |
| Coupon 3 | 77.49 | 2.08 | 0.12 | 5.70 | 99.89 |
| Ave | 87.89 | 1.88 | -0.37 | 3.23 | 99.97 |
| Std Dev | 9.15 | 0.44 | 1.74 | 2.23 | 0.07 |

Despite the low efficiency, DuPont's DBE-4 showed signs of altering the wax during the 45 minute cleaning. The cleaning chemistry softened the wax during the first 5 minutes of cleaning. By 30 minutes, the wax was sliding down the coupons and gathering at the bottom. Table 2 lists the observations made during the 45 minutes of cleaning.

Table 2. Observations

| Times | Shopmaster | Safe Strip | DBE-4 | 590 S | Uni-Clear |
|-------|--------------------------|-----------------|----------------------|------------------|-----------------------|
| 5 | very soft-dissolving | Slightly soft | very soft-dissolving | no change | good dissolving |
| 10 | good dissolving 50% gone | some dissolving | good softening | little softening | almost all clean |
| 15 | coming off in clumps | no change | some dissolving | no change | 1 all clean |
| 20 | 80% gone | no change | sliding down | no change | little remaining |
| 30 | very soft, most gone | okay | softer | darker color | all gone after 25 min |
| 45 | clumps floating at top | no change | no change | no change | n/a |

Summary:

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| Substrates: | Ceramics |
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| Contaminants: | | Adhesive | | | |
|-----------------------|-----------------------|---------------|--------------------|-------------------------------------|----------------------|
| Company Name: | Product Name: | Conc.: | Efficiency: | Effective: | Observations: |
| Buckeye International | Shopmaster RC | 100 | 87.89 | <input checked="" type="checkbox"/> | |
| EcoLink | Safe Strip | 100 | 1.88 | <input type="checkbox"/> | |
| Invista S.a.r.l | Flexisolv DBE 4 ester | 100 | -0.37 | <input type="checkbox"/> | |
| Aremco Products Inc | Crystalbond 590 S | | 3.23 | <input type="checkbox"/> | |
| Universal Photonics | Uni Clear | 100 | 99.97 | <input checked="" type="checkbox"/> | |

Conclusion: Shopmaster RC and Uni-Clear were very successful in removing the wax. Uni-Clear will be further evaluated for cleaning the Crystalbond 590.