Alternative Solvent Selection for the Vapor Degreasing Process

What is Vapor Degreasing? Why is it important?

Vapor degreasing utilizes both a liquid bath and a vapor space to clean various fluxes and salts off of electronic parts. A vapor degreasing operates at a high temperature and often includes a spray wand, to supply additional thermal and mechanical cleaning.

Flux is necessary for the soldering process however, if left on, over time flux can cause corrosion and circuit failure. As such it must be removed before the electronic part is used.

Figure 1: Diagram of vapor degreasing unit

Scope and Impact

The scope of this capstone project was to work with Crane Aerospace engineers to test and replace their current solvent. The impact of this project is both Crane Aerospace and the environment as current solvents used across the industry no longer meet EPA requirements and thus must be replaced.

Additionally, adopting a more eco-friendly degreasing solvent will align with industry trends towards greener practices. This change can lead to long-term cost savings and a positive environmental footprint, positioning the company as a leader in sustainable aerospace manufacturing.

Beaker Tests

Phase I, a preliminary test beaker test was conducted in order to select the best performing solvents. Coupon samples, which were hand soldered 60-90 minutes prior to testing, were used.

Procedure:

- These samples were immersed into one of three separate beakers, each containing 200 mL of a vapor degreaser solvent.
- Samples were immersed into one of three for intervals of 2, 3, 6, and 20 minutes,
- After each immersion interval, the coupons were dried for 1 minute.
- A stir bar was used to ensure consistent agitation of the solvents.

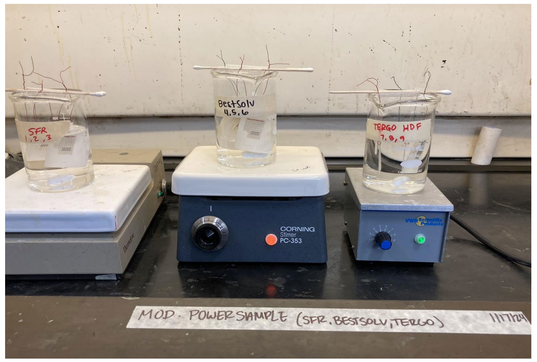

Figure 2. Setup for beaker testing, with Vertrel SFR (left), BestSolv (middle), and Tergo HDF (right) at similar agitation rates.

Results:
Two beaker tests were conducted on with two solvents (Tergo HDF and Best Solv) tested against Vertrel SFR. Both tests support the conclusion that the BestSolv solvent leads to similar results as the control solvent, Vertrel SFR. Using these observations from both experiments as well as previous experiments conducted by Crane.

Compatibility Test 1

After the beaker tests, BestSolv was chosen for further compatibility testing, compared to Vertrel SFR.

Objective: Test compatibility of metals, epoxy, inks, silicone, and polymers with BestSolv and Vertrel SFR.

Procedure:

- Materials analyzed included plastic caps, silicone reinforcement, toroid coils, ink (MFP Series™), glaze, bobbin wires, and silicone MAGS (SMRT parts).
- Samples were imaged pre- and post-cleaning.
- Observations included smearing, material loss, ink changes, scratches, and cracks.
- Half of the MFP and SMRT samples were tested in Best Solv; the remaining MFP samples in Vertrel SFR.

Results:
The most damage was seen in the toroid coils treated with Vertrel SFR, the material pulled away from the wall. No damage or deformation was observed from parts treated with BestSolv.

Figure 3. Silicone Puck that was put through testing (left) and the silicone before being mixed (right)

Compatibility Test 2

An additional compatibility test was performed to ensure that the BestSolv did not degrade the components used in larger manufactured parts.

Procedure:

- Components tested were comprised of a combination of plastics, metals, and ceramic parts.
- The components were imaged using optical microscope to examine areas of interest and pictures were taken of pre-damaged areas.
- Following the same procedure used at Crane the samples underwent the vapor degreasing cycles, with one in BestSolv and one with Vertrel SFR.

Results:
Both solvents had comparable results, there were some components that experienced cracking, swelling, or surface degradation. .

Conclusion:
Based on the compatibility and cleaning testing we recommend the use of BestSolv for vapor degreasing.

Acknowledgement & References

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