Technical Bulletin

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Postcuring Recommendation for ARLON® Silicone Flexible Heater Substrates

Summary

This Technical Bulletin outlines why and how to do postcuring for silicone flexible heater substrates.

Why Postcuring?

Postcuring at high temperatures is a common process in manufacturing silicone flexible heater. Postcuring must be completed in an air-circulated oven with a supply of fresh air. There are two reasons for undergoing a postcuring process:

To Eliminate Blooming at Surface

After silicone rubber is cured, some curing byproduct may migrate out to the surface of silicone rubber. Byproduct forms a thin layer of white blooming at the surface. This blooming becomes visible and stabilizes after ~two weeks. Examples are shown in Figure 1 on the following page. Blooming at the surface negatively affects product aesthetics as well as PSA adhesion for some applications. Postcuring at higher temperatures helps to eliminate blooming at the surface.

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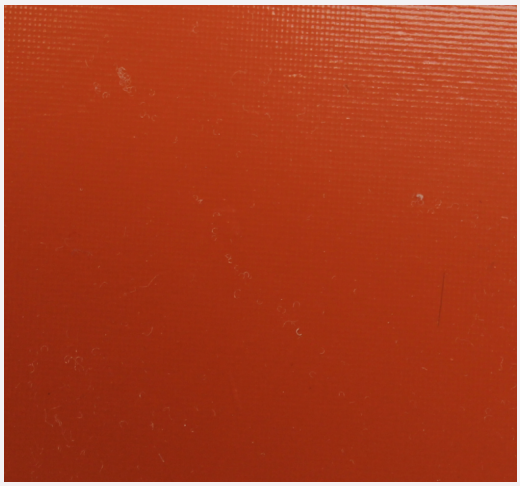
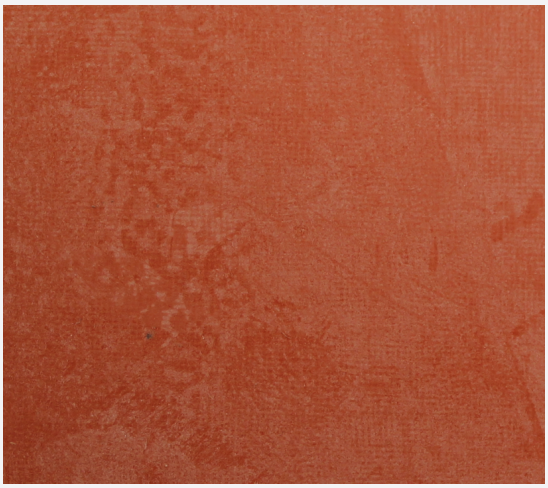


Before Storage

Figure 1



Two Weeks of Storage

To Eliminate Low Molecular Weight Volatile in Bulk Silicone rubber also has some low molecular weight volatiles in its bulk. These low molecular weight volatiles are not a part of the cross-linking network even after the silicone rubber cures. They can come out as outgassing during flexible heater applications at higher temperatures. Outgassing can cause bad odor and contamination, especially in food, semiconductor, and medical applications. Postcuring at higher temperatures helps drive out volatiles before end users use the silicone flexible heater substrates.

"27" and "58" Series Flexible Heater Substrates

Postcuring Recommendation to Eliminate Blooming at Surface

A colorimeter is used to measure surface blooming. On the next page, in Figure 2, Delta E represents the color difference between a surface without any blooming and a surface with blooming. The larger Delta E, the more blooming. Blooming stabilizes after ~2 weeks storage, as shown in Figure 2. Postcuring at high temperature can eliminate blooming.

However, blooming could come back if the postcuring temperature and postcuring time are not adequate. Figure 3 gives a recommendation for the postcuring conditions needed to eliminate blooming (the criteria is Delta E<1.5). The recommendation for postcuring temperature and time shown in Figure 3 ensures that blooming does not come back under these postcuring conditions.

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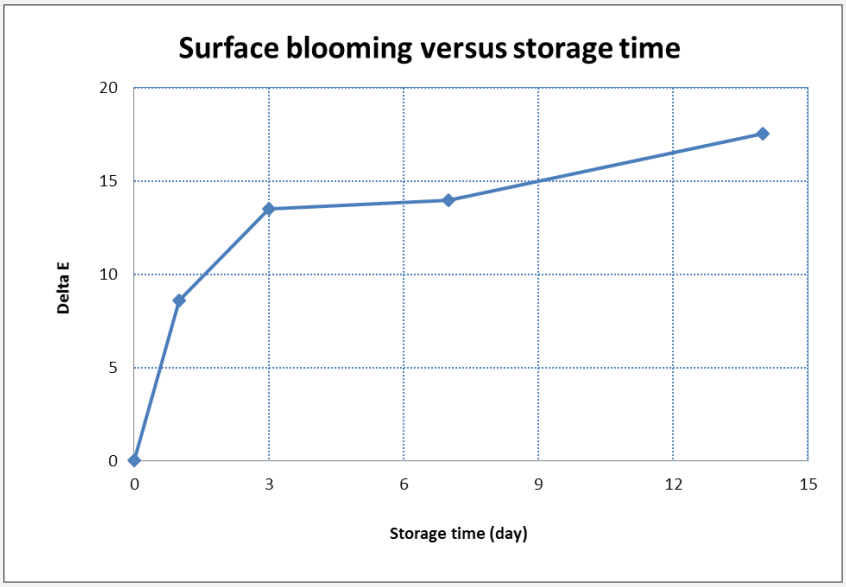

Figure 2:
Blooming versus Storage

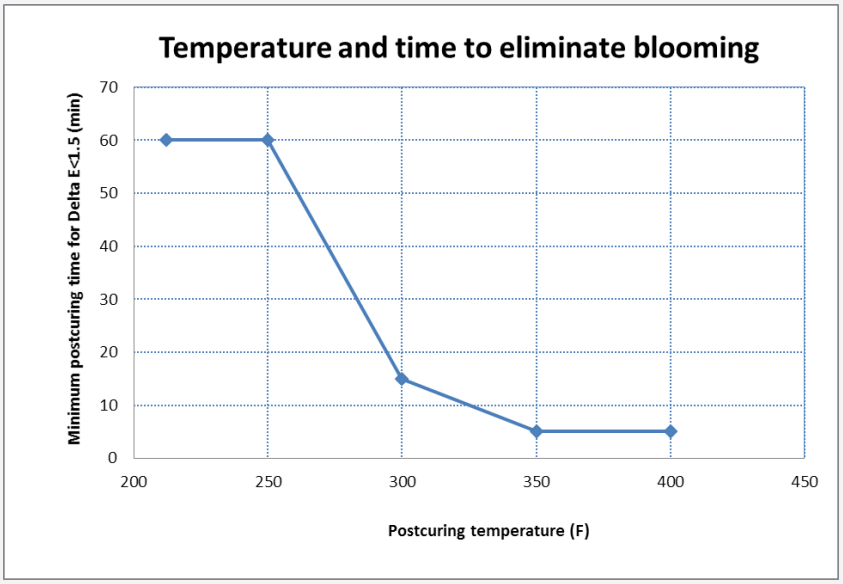

Figure 3:
Postcuring Recommendation

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Postcuring Recommendation to Eliminate Low Molecular Weight Volatile in Bulk

Weight reduction is used to measure low molecule volatile content. Figure 4 shows weight reduction with postcuring time at 400F. It takes a much higher temperature and a longer time to eliminate low molecule volatile as opposed to eliminating blooming at the surface. All Rogers datasheets for flexible heater substrates recommend 400F for 2 hours, typical postcuring conditions. The exact postcuring time can vary depending on the product thickness.

- Thickness<60 mils: 400F*2hr
- Thickness=60-150 mils: 400F*4hr
- Thickness=150 mils: to be evaluated

If 400F is too high to use for some applications , a vacuum oven can be used to lower the postcuring temperature.

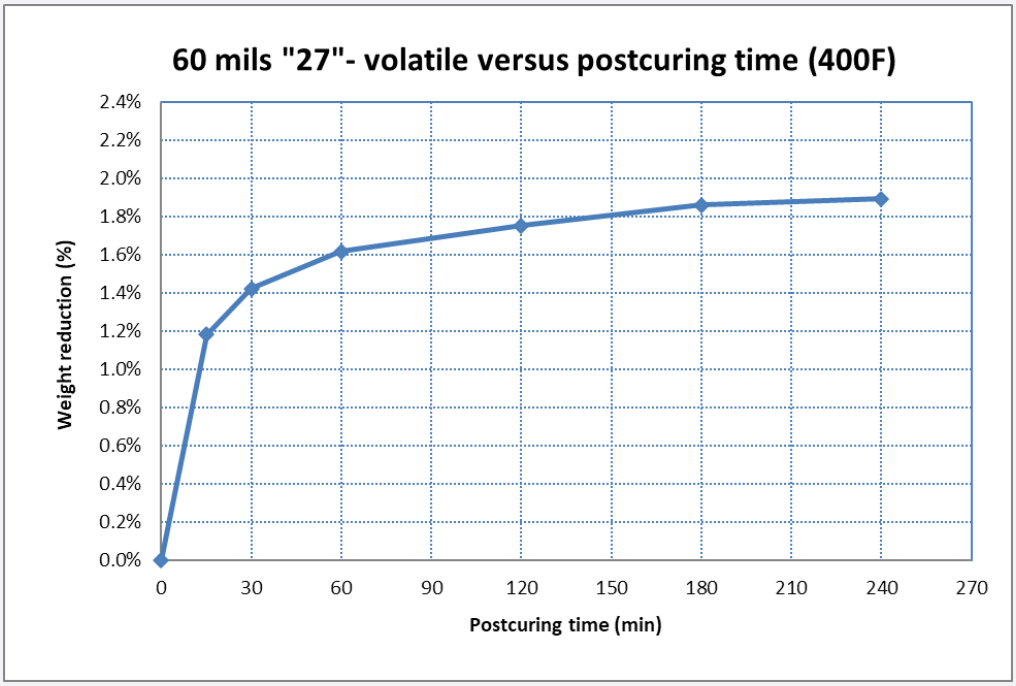

Figure 4: Postcuring Time versus Volatile Reduction

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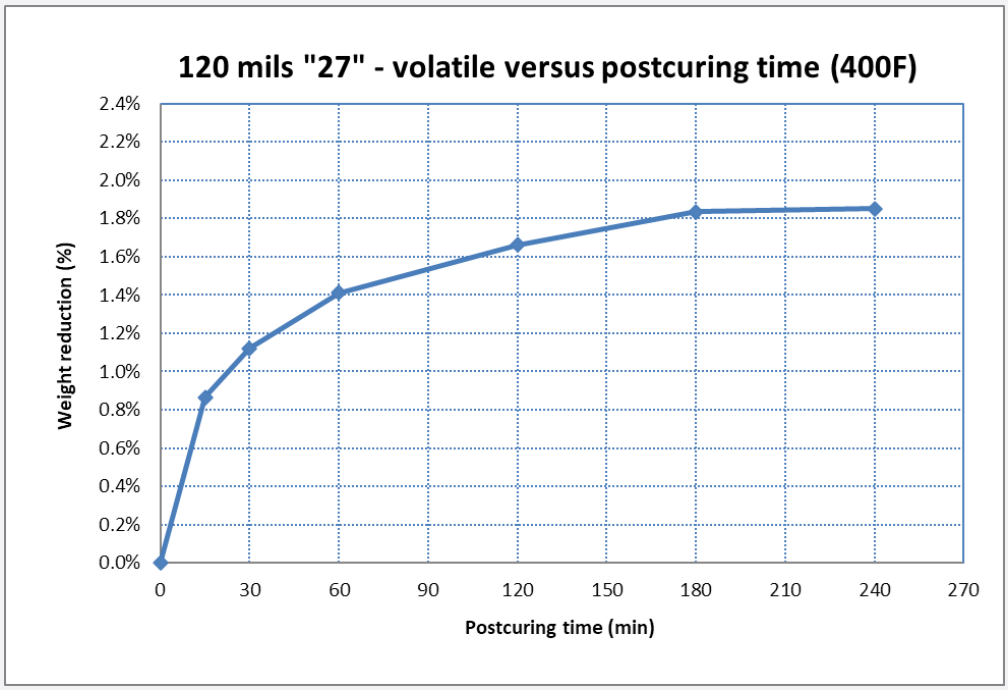

Figure 4: Postcuring Time versus Volatile Reduction

"57" and "46" Series Flexible Heater Substrates

Postcuring Recommendation to Eliminate Blooming at Surface

"57" and "46" Series flexible heater substrates are different from the "27" and "58" Series. "57" and "46" Series product do not show blooming even after ~2 weeks storage, as shown in Figure 5 on the next page. Delta E is only ~0.20 after two weeks storage. "~0.20" is within test error limits, and much less than the threshold of 1.5. Postcuring at a high temperature is not necessary to eliminate blooming at the surface.

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Postcuring Recommendation to Eliminate Low Molecular Weight Volatile in Bulk

"57" and "46" Series flexible heater substrates are similar to the "27" and "58" products in terms of low molecular weight volatile in bulk. It also contains 1-2% low molecular weight volatile in bulk. On he next page, Figure 6 shows weight reduction with a postcuring time at 400F. The data sheets for "57" and "46" Series flexible heater substrates also recommend 400F for 2 hours, typical postcuring conditions, the same as is used for the "27" and "58" Series. Exact postcuring time can vary, depending on the product thickness.

- Thickness<60 mils: 400F*2hr
- Thickness=60-150 mils: 400F*4hr
- Thickness=150 mils: to be evaluated

If 400F is too high to use for some applications, a vacuum oven can be used to lower the postcuring temperature.

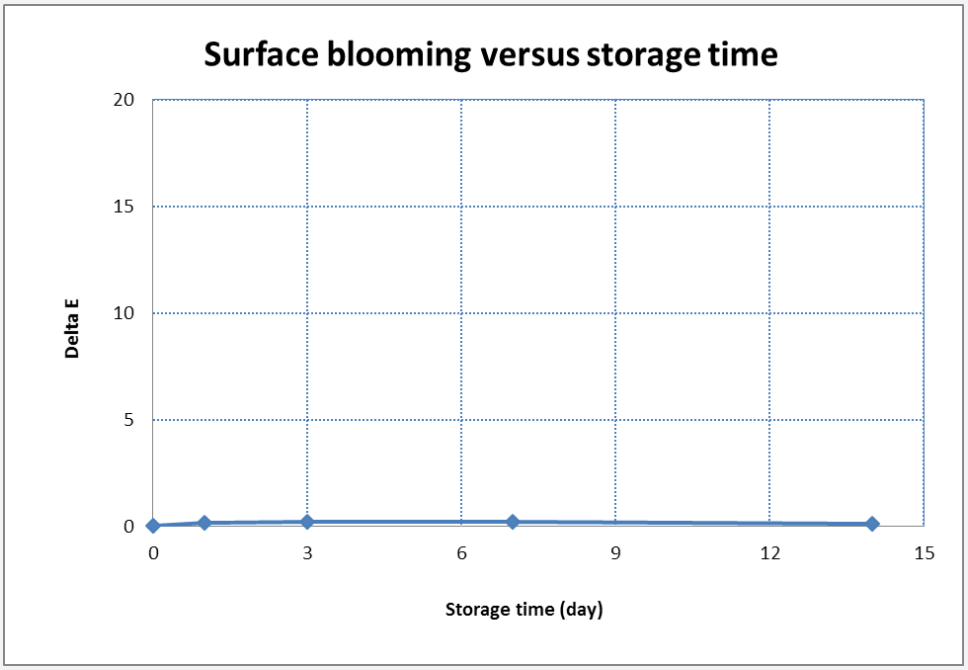

Figure 5:
Blooming versus Storage

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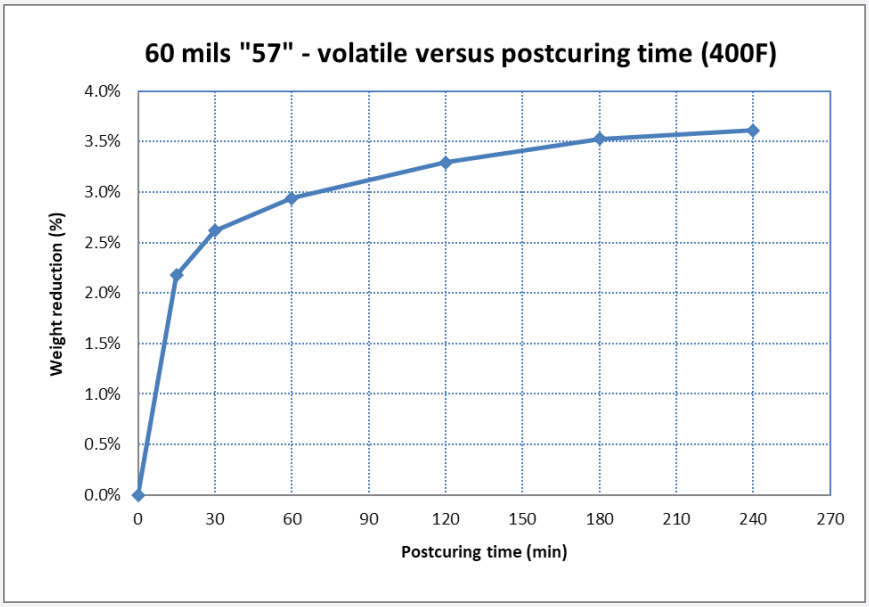

Figure 6: Postcuring Time versus Volatile Reduction

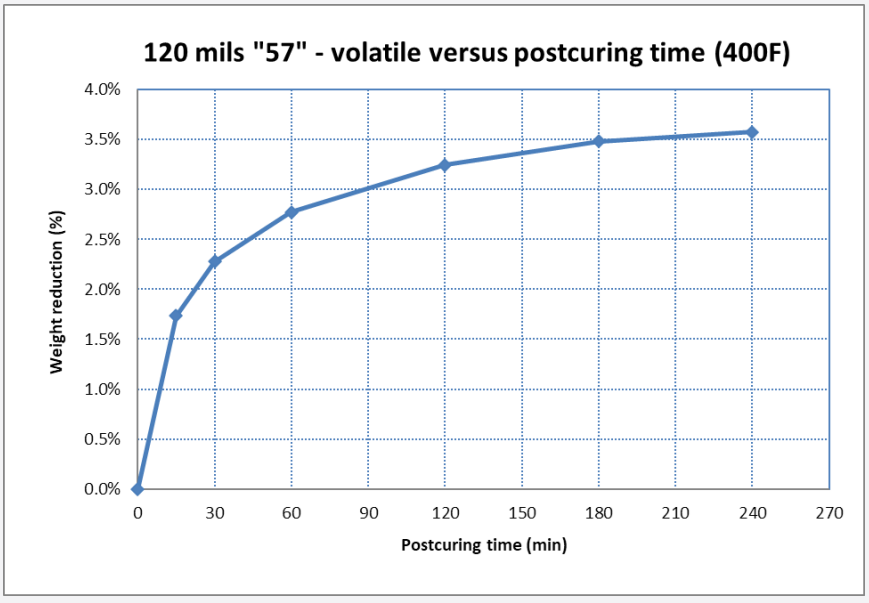

Figure 6: Postcuring Time versus Volatile Reduction