EVERIX

Technical note

Storage effects on Everix acrylic series filters

Storage temperature can permanently change the spectral performance characteristics of the product.

Everix Optical Filters are composed of thin layers of acrylic-based polymers. Changes in heat and humidity can induce small thickness changes in the polymer layers, resulting in permanent spectral shifts if they are not stored properly. This tech note describes the recommended storage parameters to maintain spectral performance.

Polymethyl methacrylate (PMMA) is one of the primary components of Everix filters. Like all glassy polymers, there are a variety of relaxation processes leading up to the "glass transition" temperature, T_g. These relaxation mechanisms have the potential to affect layer thicknesses within the thin-film stacks and the subsequent spectral performance.

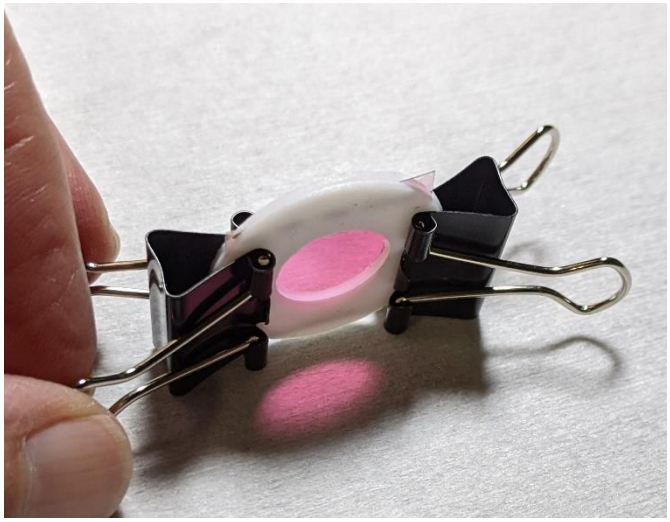

Figure 1. Thin-film filter coupon ready to be placed in the oven

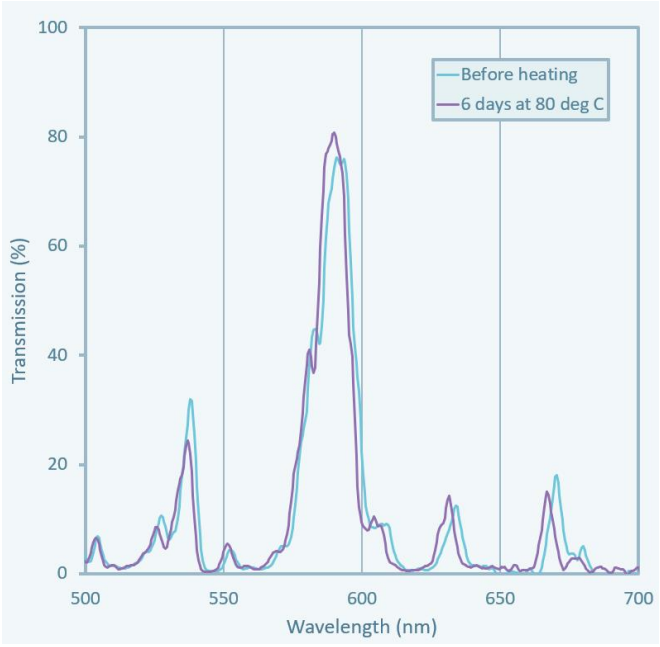

Figure 2. Typical spectra measured before and after heating

To investigate this possibility, we prepared small coupons from 3 different thin film draws with different spectral characteristics. These were clamped between Teflon washers (Figure 1), the spectrum was measured and they were

placed in an equilibrated oven at the desired temperature for differing amounts of time, removed, cooled and measured again (Figure 2).

The first set of experiments looked at short time periods to get an idea of how the filters would respond to transient hot temperatures

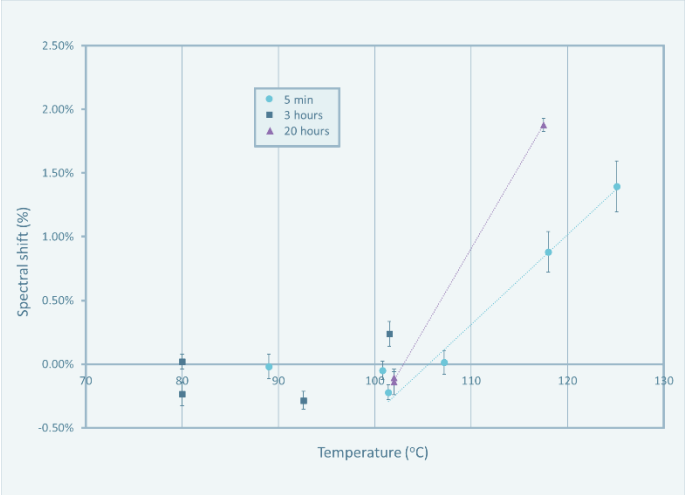

Figure 3. Spectral shift versus temperature for 3 different time periods

(like a hot car or truck). As seen in Figure 3, the filters stay relatively unchanged up to the 100-110°C range where the spectrum starts to shift to longer wavelengths, indicating a thickening of the thin-film stack. The T_g of the polymers used to manufacture the product is also in this range.

Next, we performed a simulated storage experiment. Filters were placed in an oven up to 93° C for many hours to mimic storage in a non-temperature-controlled environment. As seen in Figure 4, no significant spectral changes are seen in either notch or bandpass filter stacks up to 10 days.

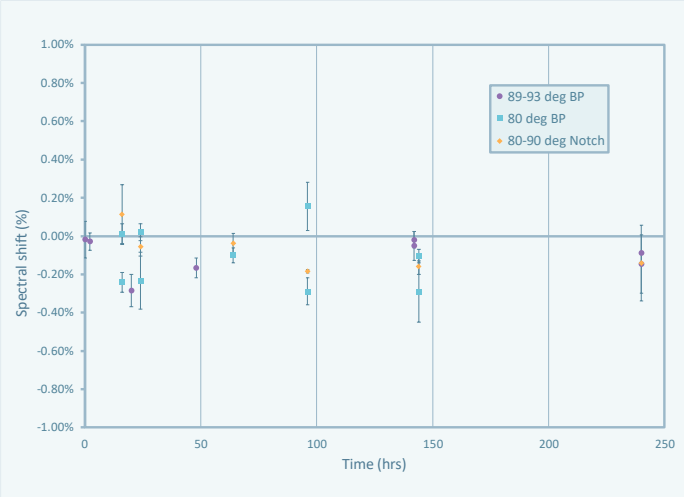

Figure 4. Spectral shift (% of initial wavelength) versus time

Customers can feel confident that they will not observe spectral changes in their filters if they are kept at temperatures below 93 degrees. Note that there is slight softening of the polymer even at these temperatures- indents of the binder clips can be observed.