

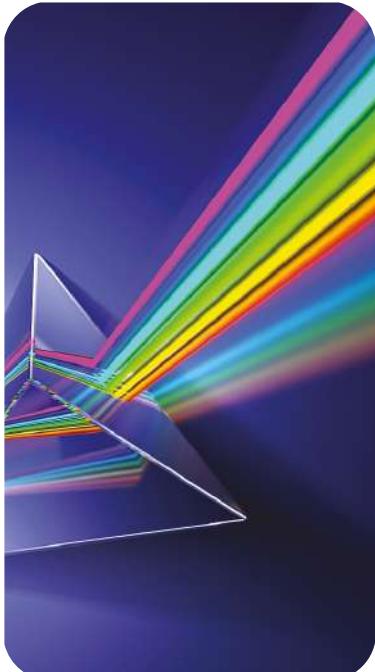
Understanding Acceptable Epoxy Color Variations

WHAT

How color can vary in epoxy adhesive components.

WHY

Uncured epoxy color differences do not translate into a change in performance.



Epoxy adhesive components can be supplied in many different shades and colors, often varying lot-to-lot in appearance. Visual color differences are monitored closely and only after proper quality control for specification adherence is each lot accepted. Quality control accepted color variations will not affect adhesive performance.

Examples of commonly accepted ranges of color differences in uncured epoxies:

Silver-Filled (Ag) Epoxy Adhesives:

For electrically conductive adhesives containing silver, color can vary from dull to shiny in its uncured state, due to lot-to-lot variation in silver flake appearance. Each batch of silver flake undergoes several processing steps before it is deemed acceptable for use in an epoxy resin system.

Silver flake variations are dependent on several factors: size of the input powder, flake processing length and flake processing time. After the flake has been properly processed, it is subjected to further quality assurance performance tests. Once the specified lot of silver flake has been approved, it is then incorporated into a resin or hardener and again tested to ensure it will achieve the desired properties required for electrically conductive epoxies.

The above three batches display uncured silver epoxy color variations ranging from a dull silver to a very shiny silver. Each of these three lots performed equally well in quality assurance performance testing.

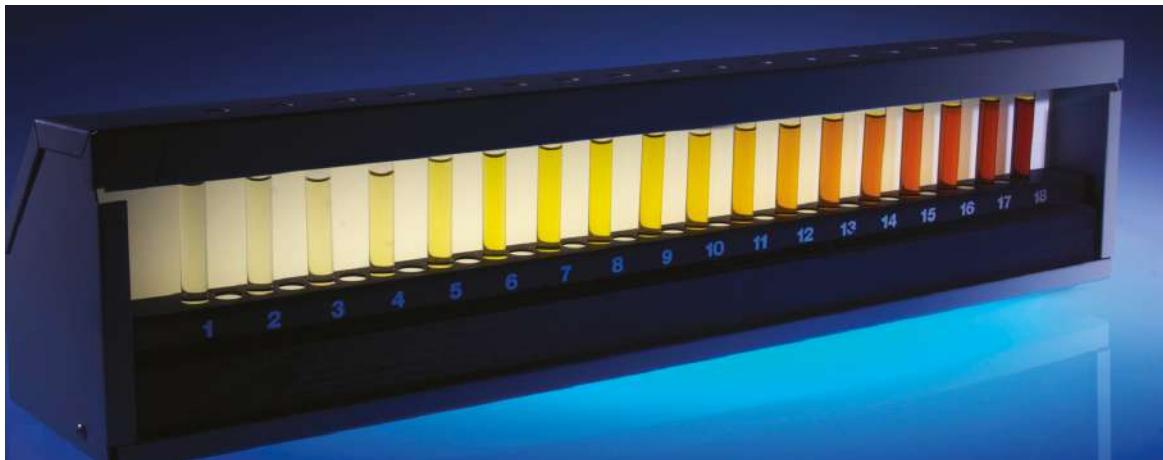
Color variations batch-to-batch, accepted within our stringent quality assurance guidelines, DO NOT affect the performance of the product.



Three Color Variations in Uncured Silver Epoxies

Optical (Unfilled) Epoxy Adhesives:

Optical epoxy adhesive products are often formulated from several raw materials, each of which may contain batch-to-batch color variations. All optical raw materials are color checked by quality assurance using a color scale known as the "Gardener Liquid Color Standards".



Gardener Liquid Color Standards

This color scale is a one-dimensional scale for yellowness. The yellowness of the transparent liquid is determined by pouring the sample into a tube and comparing it to a pre-determined and known standard. The Gardener scale ranges from '1', being the lightest, to '18' the darkest shade.

Same Optical Raw Material in Three Accepted Lots

Since some raw materials can fluctuate the full range of the Gardener scale lot-to-lot, and still be within specifications, these variations directly impact the final color of each lot of optical epoxy, but not the performance.

Despite the difference in color, each of these lots was accepted by quality control and did not impact the end product performance.



CONCLUSION

As demonstrated in this tech tip, color differences when properly reviewed by quality assurance, **do not** translate into a change in performance.