



Boatbuilders use polyurethane to protect and extend the life of their boats. Image Credit: Unsplash user Jon Flobrant

It takes a lot of work to refinish an old wooden boat and restore it to its former glory. Any holes must be patched and rotten wood replaced. The entire body of the boat must be sanded down, inch by inch, and the boards must be caulked to make it watertight. It is time-consuming, exacting labor, the results of which must be preserved using a protective substance designed to keep the wood from rotting all over again. This is where polyurethane comes in.

Polyurethane is widely used in woodworking for its protective properties. Considered essential by homeowners, craftsman, furniture makers, and contractors, polyurethane forms a protective, waterproof coating for wooden surfaces, enhancing the durability and lengthening the life of all forms of wooden objects. Typically, polyurethane is intended to be entirely clear to preserve the color of the natural wood or chosen stain. However, some oil-based polyurethanes can add a slight hue to the color of the wood they protect.<sup>1</sup>

Those who work with polyurethane depend on manufacturers for color consistency, whether they are protecting a carefully chosen stain or preserving the beauty of natural, unstained wood. As such, polyurethane must be transparent or deliver a predictable hue to allow woodworkers to [realize their vision](#). Manufacturers who produce consistent, high-quality polyurethanes are much more appealing to customers than those who do not, as woodworkers know they can depend on these polyurethanes to bring out the best in their products both functionally and aesthetically. In order to develop and capitalize on the advantage provided by consistently colored coatings, manufacturers must employ end-to-end color quality assurance processes using modern spectrophotometric instruments.



Polyurethane coatings protect richly colored wood. Image Credit: Unsplash user Ryan Riggins

#### Color Quality Assurance Is Essential for Polyurethane Coatings

The primary advantage of polyurethanes over other polymer products is that polyurethanes are made and sold in their final form in the laboratory or factory and do not require any intermediate steps after manufacture before being used.<sup>2</sup> Polymers such as polyethylene or polypropylene, on the other hand, are first produced and sold in an intermediate form, such as films, powders, and granules. To create a final product, they must be processed a second time. Due to the efficiency of the polyurethane process, color quality assurance processes are relatively simple for manufacturers to implement.

First, manufacturers must test the [color of their raw materials](#). The basic building blocks of polyurethane coatings are alcohols with two or more hydroxyl groups per molecule, which combine in an exothermic reaction to produce polyurethane. These alcohols, typically toluene and methylene, must be assessed before the reaction to determine their purity and the color they will eventually

impart to the polyurethane. Ideally, these alcohols will be “water white,” or entirely transparent, prior to use. This can be [determined using the APHA/Pt-Co/Hazen](#) scale.

After the reaction is complete, manufacturers must test the finished polyurethane to ensure it is colorless or a predetermined hue. Impurities or an inexact production process can result in off-color polyurethane that will compromise the finished appearance of customers’ products. To be certain that each batch of polyurethane is the correct color before it is shipped to distributors or customers, manufacturers must diligently measure samples. The detection of unwanted coloration in finished polyurethane not only prevents customer dissatisfaction, it can also point to issues in the production process that require correction.



Clear polyurethane coatings protect wood while preserving its color. Image Credit: Unsplash user Hudson Hintze

#### Measuring Color and Haze with Transmission Spectrophotometers

To accurately [measure transparent liquids](#), manufacturers employ transmission spectrophotometers. These instruments measure the color of transparent and translucent materials by passing a controlled beam of light through a sample, then collecting and analyzing the light on the other side. In doing so, they are able to rapidly detect and quantify the exact color of the sample. These instruments are ideal for analyzing polyurethanes and their alcohol precursors, allowing you to determine how close your sample is to being water white.

Certain transmission spectrophotometers, such as [HunterLab’s Vista](#), can also measure haze in liquids. This is an essential step for determining transparency and detecting contaminants in toluene, methylene, or polyurethanes both before or after the production process to ensure that your product performs as customers expect. Unlike other spectrophotometers, the Vista can measure color and haze simultaneously, eliminating the need for multiple measurements or instruments, minimizing sample preparation time, and optimizing efficiency. The Vista comes paired with our

Essentials color management software, which is [preloaded with a comprehensive range of color scales and indices](#), including the APHA/Pt-Co/Hazen scale, making it easy to correctly classify and share color information.

#### HunterLab Quality

With over sixty years of experience [working with the chemical industry](#), we at HunterLab design our color measurement instruments to address the needs of chemical manufacturers. Our range of spectrophotometers, accessories, and customizable software options offer innovative solutions to the challenges faced by this growing industry. No matter how sensitive the chemical or delicate your process, our instruments are ideally suited to your color and haze measurement needs. [Contact us](#) to learn more about how the Vista and or any of our renowned spectrophotometers can improve your color quality assurance processes.

1. "What's the Difference Between Polyurethane, Varnish, Shellac, and Lacquer?", 2013, <http://www.diynetwork.com/how-to/skills-and-know-how/painting/whats-the-difference-between-polyurethane-varnish-shellac-and-lacquer>
2. "Polyurethanes", 2016, <http://www.essentialchemicalindustry.org/polymers/polyurethane.html>