



# Advanced Light Cure Adhesives

*Take a closer look at what these environmentally  
friendly adhesive systems can do*

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## Environmentally Friendly Light Cure Adhesives Improve Safety, Lower Cost



*Master Bond LED401 cures quickly and tack free under safe, low-cost LED light sources.*

Light cure adhesives already have a compelling value proposition thanks to their easy application and fast cure. Our latest technology breakthrough makes these adhesives even more valuable by enabling a cure to take place under a visible light wavelength of 405 nanometers (nm).

Traditional light cure adhesives, by contrast, cure under ultraviolet (UV) light sources with wavelengths between 250 and 365 nm.

A few dozen nanometers of wavelength may not seem like a big deal, but the implications are profound from both design and production standpoints. For design engineers, the ability to fully cure adhesives under visible light opens up a range of bonding, encapsulation and sealing applications that were previously not suitable for light cure products.

On the factory floor, shifting to visible light eliminates the need for expensive UV lighting equipment in favor of inexpensive light emitting diode (LED) lamps. Because commercial UV lights have the potential to cause eye injuries and skin burns, visible light also improves worker safety.

Our new adhesive technology, which we call Master Bond LED401, is the first of its kind. It required the development of a proprietary curing agent that not only allows it to cure fully under a visible light source but also preserves a wide range of desirable engineering properties. Here's a closer look at what this novel adhesive technology can do:

### Cures Fully With No Surface Tack

There have been previous attempts to shift light cures to longer wavelengths, and there are plenty of products on the market that do cure at or close to 400 nm. However, none of these attempts has been entirely successful due to a curing defect known as oxygen inhibition. This defect occurs when atmospheric oxygen curbs the free-radical polymerization process that cures almost all UV adhesives. Its telltale sign is a tacky, partially cured surface.

Oxygen inhibition is most pronounced in applications that lack a barrier to atmospheric oxygen. For example, oxygen inhibition would tend to be worse in a conformal coating application with an open air cure than it would be in an application that put the adhesive between layers of glass. Applications with thick adhesive cross sections also increase the potential for oxygen inhibition, which in the past ruled out many potting and encapsulation applications.

A common strategy for minimizing oxygen inhibition is picking adhesives that cure under more intense, shorter wavelength UV light. Unfortunately, this strategy is at odds with a shift to longer wavelength cures.

The Master Bond LED400 adhesive series eliminates this Catch 22 altogether. Even with their less intense light requirements, LED401 systems cure with a surface that's best described as glassy smooth and completely tack-free.

LED adhesives work with a wide variety of substrates, including those that block UV light transmission. They also cure deeply. The full cure extends from the surface down to sections as thick as 1/8-inch and entails no sacrifice of final

physical or mechanical properties. This depth of cure makes them suitable for use as an encapsulant, which has in the past been a problem for conventional light cure products.

## Maintains Engineering Properties

Master Bond LED adhesives have more going for them than their breakthrough curing behavior. Once fully cured, they offer a range of desirable engineering properties, including:

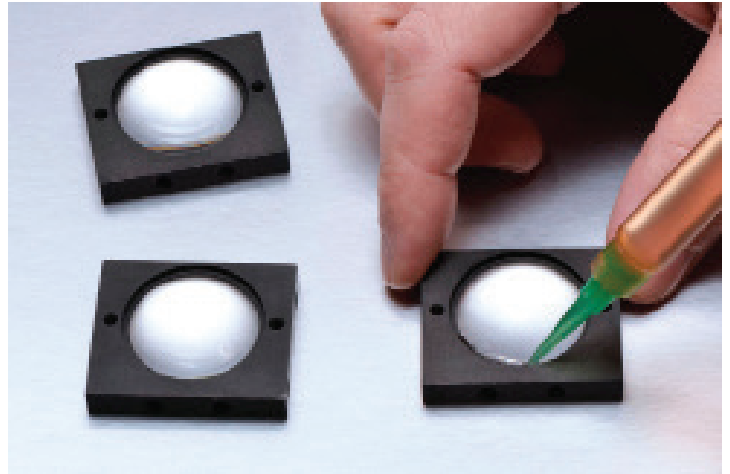
- **Adhesion** to a variety of glass, polycarbonates and acrylics as well as many other polymers and metals.
- **Chemical** resistance to water, fuels and oils as well as many acids and bases.
- **Dimensional** stability and low shrinkage.
- **Electrical** insulation properties.

Most grades of our LED400 adhesives are optically clear. For example, LED401 exhibits a very slight amber tint, though this does not hinder light transmission in any significant way. LED401 White, is an opaque white grade, that has been formulated for applications that don't require optical clarity.

## A Family of LED Cure Adhesives

Master Bond's new line of LED adhesives are available in different grades to meet a variety of bonding, encapsulation and coating needs:

- **LED401** is a one-part, no-mix, solvent-free compound offering high bond strength and wide substrate compatibility. It also delivers superior moisture resistance.
- **LED401LV** is a one-part, low viscosity, optically clear system. It cures quickly and develops a high bond strength and excellent dimensional stability.
- **LED401 White**, a higher viscosity system than LED401, is totally opaque, with a white color. Like LED401, it has excellent physical strength properties and can cure in sections up to and beyond 1/8 inch thick.
- **LED403Med** is a one-part, high viscosity system intended for medical applications. It too cures tackfree without any oxygen inhibition. **LED403Med** meets **USP Class VI** specifications and passes the **ISO 10993-5 Cytotoxicity** test.



*Master Bond LED400 adhesives have advantageously low viscosity and are easy to apply.*

## Drives Down Cost, Improves Safety

By driving down the cost and complexity of production light sources, the ability to cure with visible light eliminates the expense of buying, installing and maintaining production UV lamps. These lamps, which can cost thousands of dollars, represent one of the biggest capital equipment barriers to using UV adhesive systems.

Master Bond LED400 adhesive series, by contrast, will cure under any light source capable of emitting light at 405 nm wavelengths with an intensity of 1-4 watts/cm<sup>2</sup>. Many off-the-shelf LED lights, including inexpensive spot lamps, will meet this criteria, though it's worth confirming the specifications of the light with its vendor just to be sure.

Under the right light source, cure times are fast. In thinner sections, full cures can be achieved in 15-30 seconds—or sometimes less. Thicker sections do require longer cure times, but usually less than 1 minute.

Moving to visible light sources also eliminates a potential safety hazard from the shop floor. While most UV cure lines run safely day in and day out, they do carry the risk of eye injuries and skin burns if their operators are not careful. The lower intensity LED lights used for our new adhesive line pose no such threat.

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For further information on this article, for answers to any adhesives applications questions, or for information on any Master Bond products, please contact our technical experts at Tel: +1 (201) 343-8983.

# Light Cure Adhesives from Master Bond

Master Bond Grade	Viscosity, 75°F	Color	Shelf life at 75°F original unopened containers <i>(with no exposure to light)</i>	Service Temperature Range, °F	Description
LED401	100,000-150,000 cps	Clear	6 months	-60°F to +250°F [-51°C to +121°C]	Outstanding optical clarity; excellent light transmission. Very good dimensional stability and high bond strength with superior adhesion to surface treated metals, glass and many plastics. Superb electrical insulation properties. High viscosity yet maintains flowability. Very good chemical resistance to water, many acids, bases and oils.
LED401LV	60,000-80,000 cps	Clear	6 months	-60°F to +250°F [-51°C to +121°C]	Excellent physical properties, including outstanding dimensional stability, superb electrical insulation properties and superior chemical resistance to water, many acids, bases and oils. It also bonds well to a wide variety of substrates, such as glass, polycarbonates and acrylics.
LED401 White	>350,000 cps	Totally opaque, white	6 months	-60°F to +250°F [-51°C to +121°C]	High viscosity system has excellent physical properties and is opaque white in color. It has outstanding dimensional stability, superior electrical insulation properties and resists many chemicals. Prior to cure, it has a high viscosity consistency, yet remains flowable.
LED403Med	100,000-150,000 cps	Clear	6 months	-60°F to +250°F [-51°C to +121°C]	Widely used in the manufacture of disposable medical devices. Exceptional physical properties; high viscosity. Very good dimensional stability; lower shrinkage upon cure. High bond strength with superior adhesion to surface treated metals, glass and many plastics. Meets USP Class VI and ISO 10993-5 cytotoxicity requirement.