

Adhesives in Manufacturing

Through the last few decades, the acceptance of adhesives as a high performance engineering material has grown steadily. Adhesives contribute dramatically to structural integrity, ease of manufacture, enhanced performance, improved safety, and cost and time savings, the reasons for which are many, including:

- The adhesive bond is continuous. Upon loading, there is a more uniform distribution of stresses over the bonded area. The local concentrations of stresses present in spot welded or mechanically fastened joints are avoided. Bonded structures can consequently offer a longer life under load. The bonded joint being continuous produces a stiffer structure. Alternatively, if increased stiffness is not needed, the weight of the structure can be decreased while maintaining the required stiffness.
- Adhesive bonding does not typically require high temperatures. It is a suitable method for joining together heat-sensitive materials prone to distortion or to a change in properties from the heat of brazing or welding.
- Adhesive bonding gives a smooth appearance to designs: there are no protruding fasteners such as screws or rivets, and no spot weld marks. Small or fragile components that cannot tolerate mechanical fasteners may be joined with adhesives.
- Adhesive bonding can simplify assembly procedures by replacing several mechanical fasteners with a single bond, or by allowing several components to be joined in one operation.

All these advantages may be translated into economic advantages: improved design, easier assembly, lighter weight and longer service life.

Adhesives have found wide spread use in manufacturing processes through the past few decades. High performance structural adhesives are now widely used through a broad range of industries such as automation in the aerospace industry. Their experience amply demonstrates that, when properly selected and used, adhesives can meet the most demanding requirements in addition to delivering capabilities that may not be available through any other assembly method.

High performance adhesives are an engineering material, just like any other, and require similar understanding of their properties and process control requirements. With this understanding, manufacturers can take advantage of the many unique benefits of adhesives and remain comfortable in their long term performance, reliability and durability.

First hand experience

EXFO Electro-Optical located in Vanier, Quebec had an alignment application that was taking an extensive amount of time to complete. This bottleneck in the manufacturing process was a challenging problem. They were using a 2 part structured epoxy adhesive to glue two invar parts together. The curing time to reach 50% of full strength was approximately 12 hours. After that non-value-added waiting time they were able to remove the optical assembly from the alignment jig. Due to this adhesive assembly method, the production output was very low.

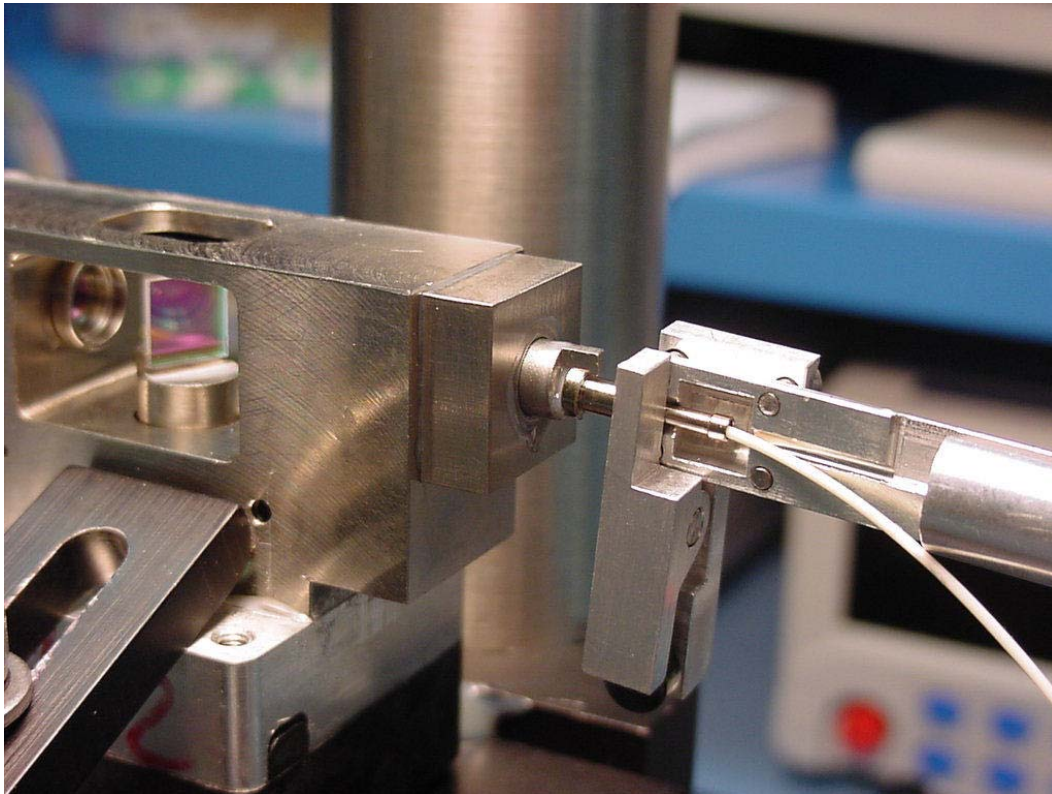
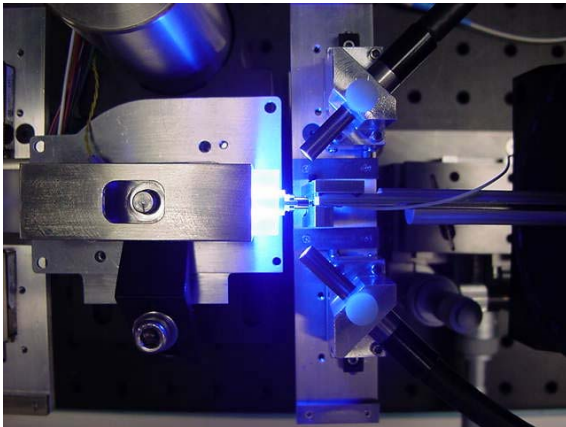
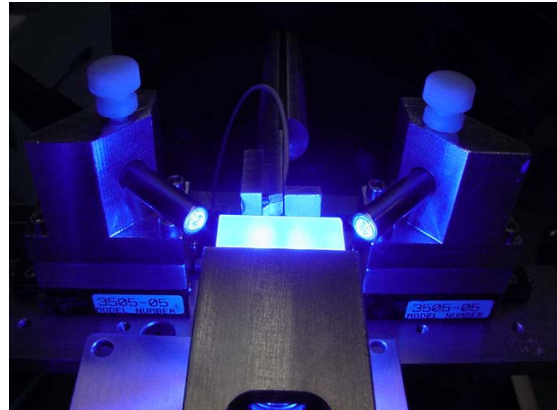
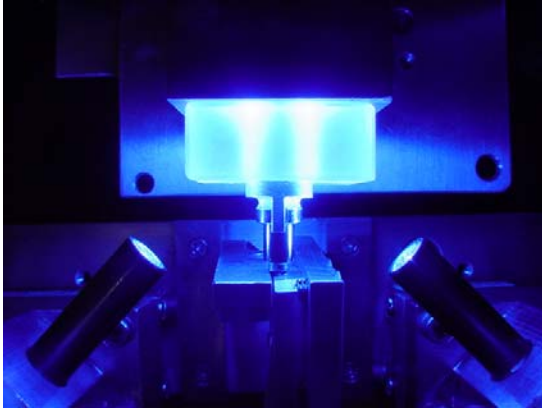


Figure 1: Previous curing method; invar to invar using epoxy adhesive: Curing time 12 hrs.

EXFO is now using a high performance optical UV adhesive and Novacure® UV/Visible spot curing system to glue a glass bloc on an invar part. With this change, EXFO has seen an improvement of the curing time reduced to 1 minute. The optical assembly can be removed from the alignment jig after only this short time and a new assembly can begin.



Figures 2-4: New assembly method; glass to invar using UV adhesive: Curing time 1 minute.

With these changes in the assembly process, the curing time significantly decreases from 12 hrs (720 minutes) to 1 minute.

This is 720 times faster and as such, the bottleneck no longer exists. Although this reduction in time is extreme, significant benefits are usually seen when the process migrates to the use of a UV adhesive.

EXFO's light-based curing systems deliver stronger and faster cures than traditional assembly methods, improving quality, speeding up production and reducing costs. This precision technology is equally effective in fully automated assembly lines and semi-automatic applications, making it suitable for every size and type of manufacturer.

In particular, the sophisticated technology EXFO has built into the Novacure[®] ensures optimum light delivery for every cure. This system delivers over 20,000 mW/cm² of curing power for stronger, faster, deeper cures. It has a patented closed-loop feedback system that continuously monitors light output at the source, signaling a microprocessor controller to adjust the guide to maintain levels.



microprocessor
unit's output to the light
consistent intensity

While EXFO does not supply adhesives, we do work with a range of adhesive manufacturers, and maintain our own test lab to evaluate the wide range of materials in the market today.

EXFO also offers a wide variety of standard and custom optics and accessories to compliment the Novacure[®] 2100 and meet the most challenging application requirements.