

# OmniCure®

UV Bonding • In Control

## OmniCure® Assembly Solutions

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### Thin Film Filter WDM Module

#### Challenge

Assembling multiple components within a WDM module while maximizing the signal through the component.

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#### Solution

The OmniCure® S2000 UV Spot Curing System with Closed-Loop Feedback technology and a dual leg High Power Fiber Light Guide.

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#### Benefit

A repeatable curing process which will maximize component yields and reduce manufacturing costs.

Wavelength Division Multiplexing (WDM) technology provides a cost-effective way to upgrade optical networks for meeting the ever increasing demand for bandwidth. WDM technology couples many wavelengths into the same fiber, thus effectively increasing the aggregate bandwidth per fiber for applications including reconfigurable optical add drop multiplexing (ROADM).

This application note provides a brief overview of the assembly process for Thin Film Filters (TFF), a specific design technology commonly used in WDM components, and highlights the important role of UV curing. WDM component manufacturers can benefit from using UV curable adhesives along with the OmniCure® S2000 UV Spot Curing System and High Power Fiber Light Guides to make the assembly of WDM modules easier and more repeatable.

### ASSEMBLY OF A THIN FILM FILTER WDM

The process described below explains the assembly of a WDM module with the use of TFFs as demultiplexers, extracting wavelengths of light from a multiplexed stream of data. An example of a Wavelength Division Multiplexed signal is shown in Figure 1.

A typical TFF WDM module requires approximately six different UV curing applications. UV curable adhesives are ideal for this application because they cure 'on-demand', allowing for precise alignment of components without the adhesive starting to cure. Once the components are aligned, the OmniCure® S2000 instantly cures the adhesive. Closed-Loop Feedback technology, unique to the OmniCure® S2000,

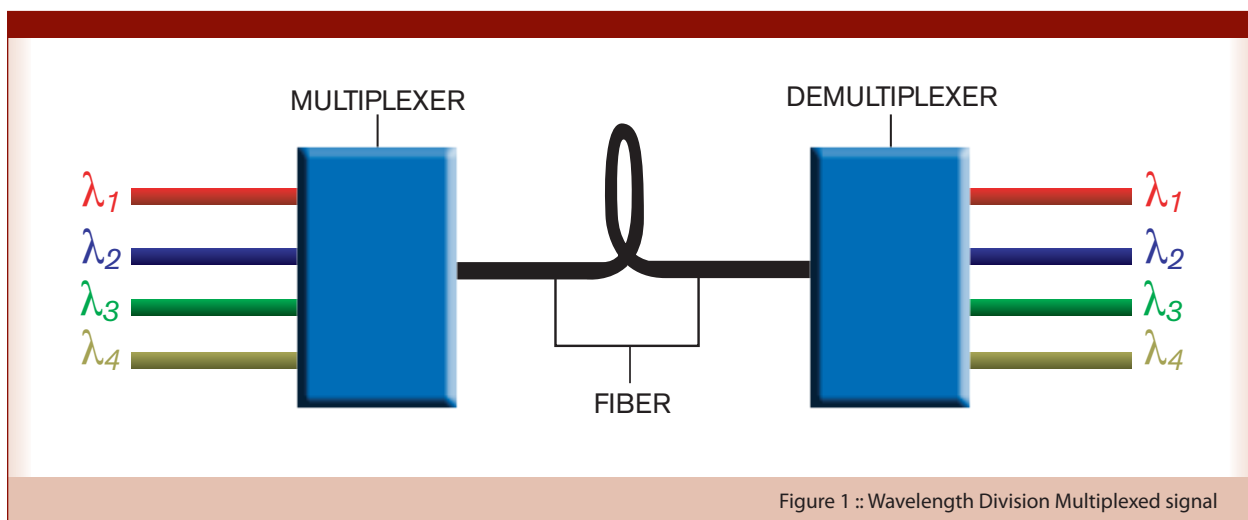


Figure 1 :: Wavelength Division Multiplexed signal

guarantees that the irradiance of the UV light is repeatable, improving manufacturing yields. The Lumen Dynamics High Power Fiber Light Guide allows for consistent, even curing from two sides simultaneously, ensuring parts do not become misaligned during the curing process.

Individual fibers are inserted into a glass ferrule through passive alignment. A **UV curable adhesive** is then applied to the wide end of the ferrule, and is drawn in by capillary action. The ferrule and fiber assembly is then

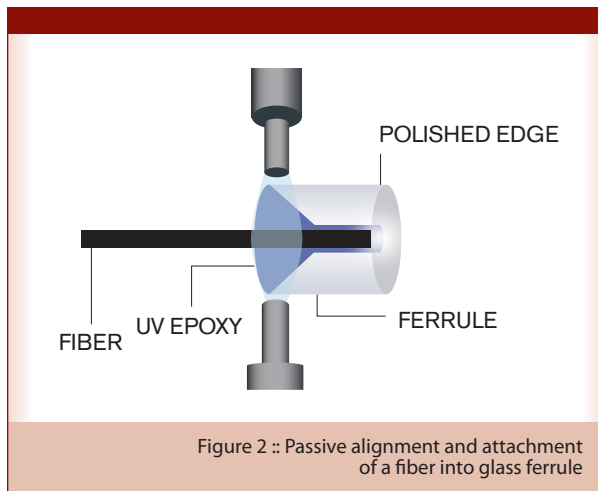


Figure 2 :: Passive alignment and attachment of a fiber into glass ferrule

exposed to **UV light** of the appropriate irradiance and wavelength, curing the UV adhesive to ensure the fiber is properly secured within the ferrule. See Figure 2.

A Gradient-Index Lens (GRIN Lens) is added to the ferrule, to collimate the light transmitted from the fiber into the adjoining components. The ferrule and GRIN Lens are actively aligned to maximize the observed signal through the component, and then a UV adhesive is used to secure the GRIN Lens in place.

It is essential that the UV adhesive is cured evenly to maintain optimum alignment of the parts. Uneven curing could cause them to be pulled out of alignment, which would result in a reduction of the transmitted signal and rejection of the part. See Figure 3.

A dual leg High Power Fiber Light Guide can be used to evenly cure the adhesive from opposite sides, ensuring that the optimum alignment is maintained. This curing process must be repeatable so that all parts are consistently joined with the maximum signal level.

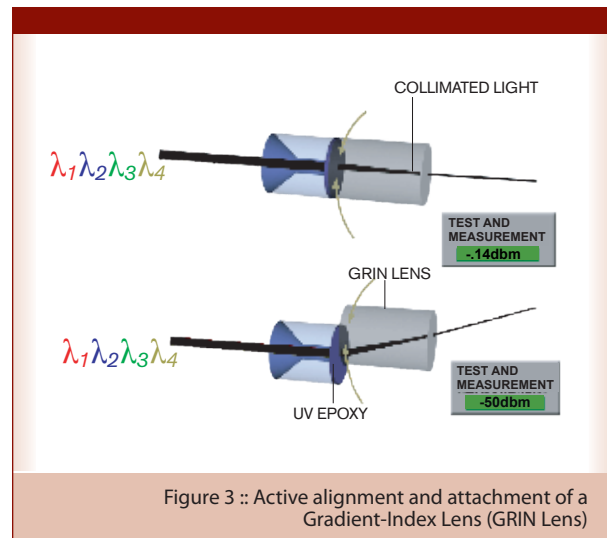


Figure 3 :: Active alignment and attachment of a Gradient-Index Lens (GRIN Lens)

Next a Thin Film Filter is attached to the GRIN Lens using a UV curable adhesive. Active alignment is required to ensure maximum signal throughput, therefore even curing is also essential. TFFs are coated with many ultra-thin layers of dielectric material, allowing them to reflect or transmit particular wavelengths depending on the properties of the coatings. The filter will transmit a particular wavelength of light ( $\lambda_3$ ) while reflecting the remaining light back to a separate fiber. See Figure 4.

To complete the component, a similar assembly process is repeated for the transmitted light path through the TFF to the exit fiber. A GRIN Lens and a ferrule are both

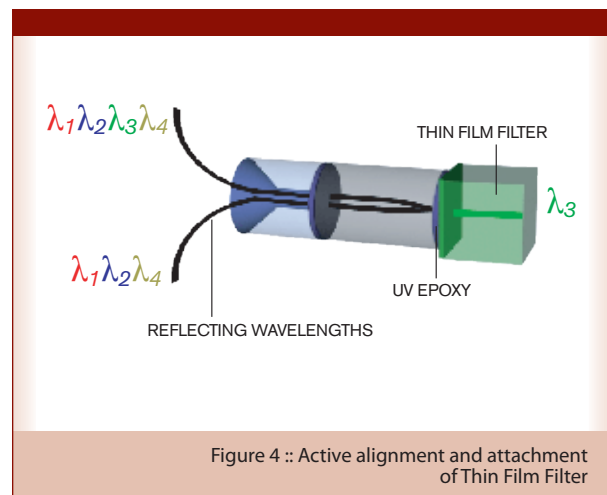


Figure 4 :: Active alignment and attachment of Thin Film Filter

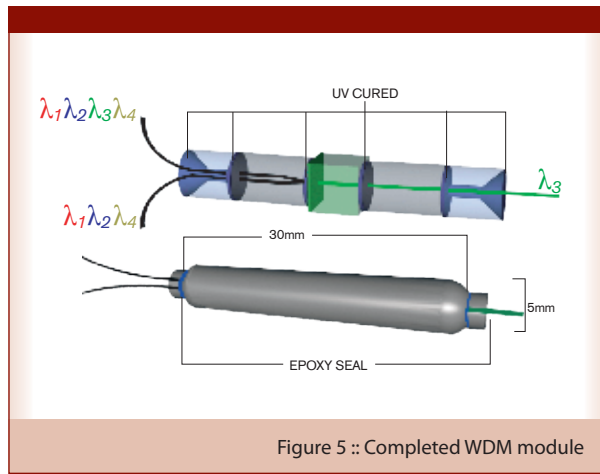


Figure 5 :: Completed WDM module

attached, using **UV adhesive and curing**, at the end opposite the input.

The TFF WDM module is then generally hermetically sealed and encased to protect the inner components. See Figure 5.

The illustration in Figure 6 demonstrates how TFFs operate as demultiplexers in an 8 channel optical network.

Manufacturing of components like the TFF WDM module requires precision alignment. Because UV curing offers a **faster, more accurate and more dependable** adhesive technique, the assembly method described here has gained wide acceptance in the photonics industry and is currently being used by some of the largest fiber optic component manufacturers in the industry.

Lumen Dynamics technology offers unique benefits over and above standard UV curing, ensuring **repeatable** irradiance and **uniform application** of UV light for optimal assembly of specialized optical components.

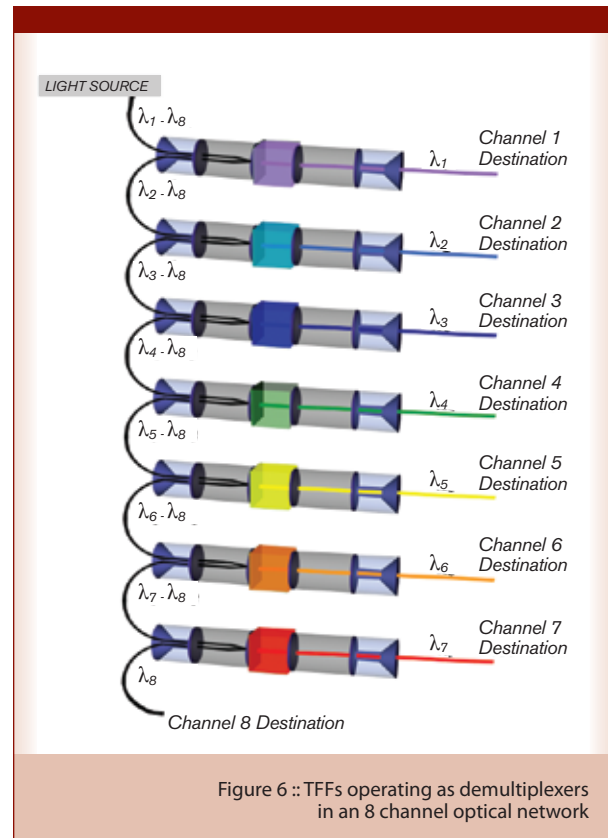


Figure 6 :: TFFs operating as demultiplexers in an 8 channel optical network

## LUMEN DYNAMICS UV CURING TECHNOLOGY – PRECISE AND REPEATABLE

- The OmniCure® S2000 UV system cures UV adhesives in seconds. Because UV adhesives will cure 'on-demand', the WDM components can be precisely aligned and then instantly cured in place to ensure maximum signal through the component.
- The Closed-Loop Feedback technology found in the OmniCure® S2000 system continuously monitors light output at the source, to maintain consistent, repeatable irradiance levels.
- Lumen Dynamics' proprietary dual leg High Power Fiber Light Guide provides an equal distribution of energy down each leg to ensure uniform curing of the adhesive. Even application of UV light ensures alignment is maintained during the curing process.



**LUMEN DYNAMICS**

PUTTING YOU IN CONTROL

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