OmniCure®
UV Bonding • In Control

OmniCure® Assembly Solutions

Biosensors

Challenge

Repeatable, low cost, assembly of biosensors.

Solution

The OmniCure® S2000 UV spot curing system with Closed-Loop Feedback technology using a light curable acrylate adhesive.

Benefit

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

White Paper: OMNICURE BIO001/10
September 10, 2010

A biosensor is an analytical device which converts a biological response into an electrical signal. They are becoming the common choice for a cost-effective diagnostic tool with the capability to render efficient, easy-to-use, yet accurate diagnosis.

While technological advances in biosensors are allowing this technology to cater to an extensive range of applications in a number of fields, such as industrial and environmental testing, the largest applications have been in the healthcare sector including:

- Glucose Detection
- Pregnancy Testing
- Blood Testing
- Breath Analyzers
- Cancer Diagnosis

Glucose detection is the most widely used application of a biosensor, driven by the increasing incidence of Type II diabetes in both developed and emerging markets. Approximately 26 million people in the U.S. have diabetes, and if the trend continues, more than 37 million people will be living with the disease by the end of 2015.[1]

The major barrier to the growth of the biosensors market is the high cost of the devices. This barrier can be removed with the advent of better technologies and more efficient manufacturing techniques. This whitepaper will show how using the OmniCure® S2000 UV spot curing system with proprietary Closed- Loop Feedback technology will help biosensor manufacturers achieve a fast, low-heat and repeatable assembly process to maximize yields and minimize assembly costs.

The demand for biosensors is due in large part to Point of Care (POC) testing; defined as diagnostic testing at or near the site of patient care. The driving notion behind POC is to

A typical biosensor consists of the following main components:

Sensitive Biological Substance – often created by biological engineering these include proteins, enzymes, nucleic acid, oligonucleotides, tissues, microorganisms, and antibodies

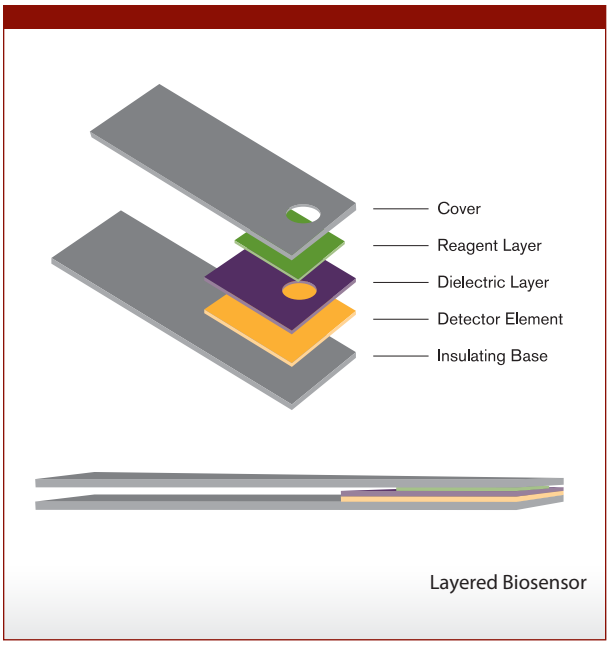
Transducer or detector element – transfers the signal resulting from the interaction of the analyte with the biological element into another signal which can be more easily measured and quantified. The signal can be optical, calorimetric, potentiometric, amperometric, or piezoelectric

Signal Processor – displays the result in a user-friendly manner

bring the test conveniently and immediately to the patient; increasing the likelihood that the patient will receive the results in a timely manner. The POC market grew by 11% in 2008 and was valued at US$12.6 billion.[2] The impressive growth of the POC diagnostic testing market is principally due to the increased adoption of self-testing by the public. The global self monitoring blood glucose market is forecast to grow from $9.6B in 2008 to $19.7B in 2015 with an annual growth rate of 10.8%.[3]

Challenge

Manufacturing of a biosensor typically includes assembly of the components in multiple layers. The detector element is placed on an insulating base, followed by a precisely designed dielectric or insulating layer and finally a reagent layer. The function of the reagent layer is to convert glucose, or another analyte, into a chemical species which is measurable by the detector element. The function of the dielectric pattern is to insulate the detector element from the test sample except in a specifically defined area in order to enhance the reproducibility of the sensor reading.



Layered Biosensor

A precisely defined area is important because the measurement of the sensor is dependent on both the concentration of the analyte and the area of the detector element which is exposed to the test sample. Therefore, it is very important that this defined area is consistent and repeatable in the manufacturing process in order to achieve consistent and repeatable readings between biosensors. A dielectric layer can be reproducibly fabricated using specialized UV curable acrylates.

Solution

A typical biosensor consists of the following main UV curable acrylates are well suited for this application as the cured adhesive is chemically inert and provides suitable insulative properties for the dielectric pattern. The rapid, cure-on-demand nature of UV curable acrylates is ideal for manufacturability as the patterns can be cured immediately after they have been dispensed on the detector element to ensure that the precise pattern is maintained.

The OmniCure® S2000 UV spot curing system uses a 200W lamp to rapidly cure the acrylate adhesive in a low heat process. The lamp includes a proprietary dichroic coating on the reflector to reduce the Infrared (IR) energy reaching the substrate, minimizing the amount of heat on the sensitive detector element. The OmniCure® S2000 also includes a band pass filter to only allow specific wavelengths of light through to the parts; virtually eliminating all unwanted IR for greater heat reduction. When curing a UV acrylate, it is important to maintain a very repeatable irradiance level. While acrylates provide the benefit of curing very rapidly with UV exposure, it is also possible to cure them too quickly. This could have detrimental effects such as causing shrinkage in the material during the curing process. This could potentially change the size or shape of the dielectric pattern, therefore changing the reading of the sensor.

The OmniCure® S2000 UV spot curing system prevents these problems by allowing for very precise selection of irradiance levels in 1% increments. Once the optimum irradiance level has been determined, the OmniCure® S2000 includes Closed-Loop Feedback technology to monitor and maintain the irradiance level of the UV curing process. This proprietary technology ensures a repeatable manufacturing process resulting in a high product yield of repeatable biosensors.

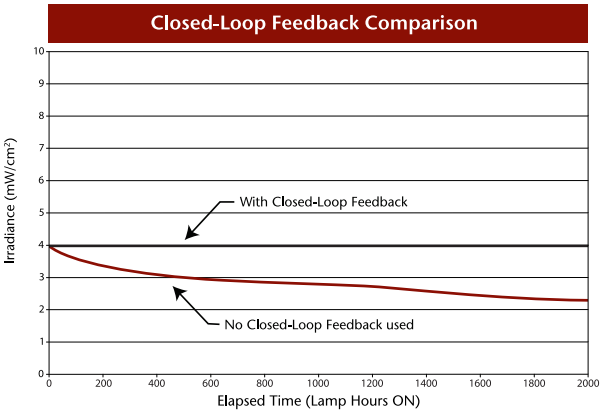
Manufacturing of biosensors poses challenges to repeatedly assemble sensitive components in a low heat, low cost process. UV acrylates must be cured in a controlled and repeatable process in order to create a specific size and shape of dielectric pattern. Lumen Dynamics' OmniCure® technology offers unique benefits over and above standard UV curing, ensuring low heat, repeatable curing for cost effective assembly of specialized medical electronic components such as biosensors.

Solution Benefits

OmniCure® UV Curing Technology – Precise and Repeatable

- The OmniCure® S2000 UV system cures UV acrylics in seconds and can easily be integrated into fully automated production processes.

- The Closed-Loop Feedback technology found in the OmniCure® S2000 system ensures repeatable irradiance levels.
- The OmniCure® S2000 lamp includes a dichroic filter to virtually eliminate IR light for a low heat curing process.
- The OmniCure® S2000 offers a choice of 5 different filter options to provide further low heat curing for sensitive components.



Lumen Dynamics' Proprietary Closed-Loop Feedback

Over time, lamp intensity diminishes effective curing. The OmniCure® S2000 internal intensity sensor monitors light output in real time, and opens the iris to automatically correct light output within +/-5%, ensuring repeatable and measurable doses of energy leading to increased yields and quality.

A PLC/audible alarm warns when the lamp can no longer generate the set irradiance level. This feature allows you to use your lamp until the end of its lifetime, without the requirement to check for lamp intensity.

Calibration with the OmniCure® R2000 Radiometer offers real time display of irradiance on the OmniCure® S2000.

- The only system that can be calibrated in real time for NIST accuracy
- Ideal for automated or semi-automated environments
- Developed by Lumen Dynamics based on over 25 years of expertise in UV light-based technology

Technical Specifications

OmniCure® S2000

The OmniCure® S2000 UV/Visible Spot Curing System is the most intelligent UV adhesive curing system of its kind in the UV assembly manufacturing processes. Its enhanced features provide the user with optimum power and outstanding control features that make the S2000 the ideal solution for both automated and manual adhesive curing processes.

Features:

- 200W UV lamp technology with up to 30W/cm^2 of output and a 2000 hour lamp life guarantee
- Closed-Loop Feedback technology
- Fast shutter activation time
- Patented Intelli-Lamp® technology to cool lamp and monitor lamp hours

Summary

The major barrier to the growth of the biosensor market is the high cost of manufacturing these devices. This barrier can be eliminated with the advent of better technologies and more efficient manufacturing techniques. Using the OmniCure® S2000 UV spot curing system with proprietary Closed-Loop Feedback technology will help biosensor manufacturers achieve a fast, low-heat and repeatable assembly process to maximize yields and minimize assembly costs.

1. American Diabetes Association, www.diabetes.org
2. Point of Care Diagnostics, Espicom Business Intelligence, Nov. 2009
3. Article "Global Self-Monitoring Glucose Market", www.pressabout.com, Oct., 2009, Source GlobalData

OmniCure® offers advanced UV/Visible bonding solutions that provide global assembly manufacturers with unparalleled, simple to use control and repeatability in light-based curing processes. Utilizing significant UV precision assembly expertise and innovative control technology, OmniCure® leverages its unique capabilities to ensure consistent reliability and highest product quality making us the industry standard in UV curing systems. Customers are able to achieve maximum uptime and reduced manufacturing costs.

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