

Assembly of Cell Phone Speakers

The Challenge

Assembly of durable micro speakers for cell phones with short manufacturing cycle times while achieving optimum acoustic properties.

The Solution

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

The Benefit

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

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Application Overview

Light curable adhesives are often used in the assembly of speakers where a strong and flexible bond is required to join plastic and metal parts. Micro speakers used in cell phones provide some unique challenges for speaker manufacturers to produce small, cost-effective speakers which are subjected to harsh conditions. At the same time, cell phone speakers are required to provide the highest possible acoustical properties as demanded by consumers who are increasingly using their phones for music and other multimedia applications. This application note provides a brief overview of the assembly process for micro speakers used in cell phones, and highlights the important role of UV curing. Micro speaker manufacturers can benefit from using the OmniCure® S2000 UV Spot Curing System and High Power Fiber Light Guides to make the assembly of micro speakers a cost-effective, repeatable process.

Assembly of Cell Phone Speakers

UV curable acrylics are widely used in the assembly of micro speakers to provide a short manufacturing cycle. In this automated production process, the individual elements are bonded in 2 to 3 seconds. The adhesives must rapidly join parts of different materials such as plastic and metal and provide a very strong bond, able to withstand the harsh conditions experienced by cell phones, such as shock and high temperatures.



FIGURE 1: Phone speakers

The OmniCure S2000 UV Spot Curing System has proven to be an effective solution in the manufacturing of micro speakers by providing fast and repeatable curing of UV adhesives. The OmniCure S2000 is easily integrated into automated manufacturing processes and by using multi-legged High Power Fiber Light Guides it is possible to evenly cure multiple points simultaneously, for a very cost-effective process.

High-performance micro speakers with broadband frequency are essential for consumers to enjoy the multimedia functions in cell phones. However, with the increased size of multimedia liquid crystal display windows, space for micro speakers is relatively reduced to maintain the same phone size. The limited size of the speaker can lead to imperfections in the low-pitched sound, therefore it is essential to have a very high quality enclosure for the speakers to extend the low frequency.

A basic understanding of how a speaker works will help to show the specific areas where UV spot curing systems can be effectively used to insure a very high quality assembly.

The diaphragm, usually made of paper, plastic or metal, has its wide end attached to the suspension, a rim of flexible material that allows the cone to move. The narrow end of the diaphragm's cone is connected to the voice coil. The voice coil is attached to the basket by the spider, which holds the coil in position, but allows it to move freely back and forth. A permanent magnet is located directly below the voice coil.

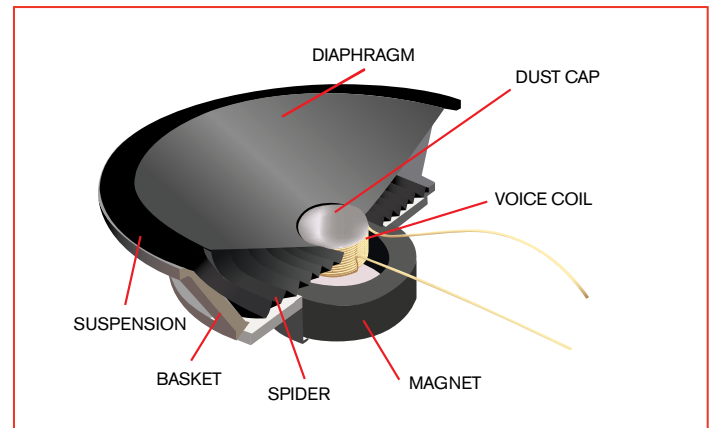


FIGURE 2: Shows basic components of a speaker

A speaker produces sound waves by rapidly vibrating the diaphragm. This is done by electrical current flowing through the voice coil, which is an electromagnet. Changing the flow of the current changes the magnetic forces between the voice coil and the permanent magnet. This moves the coil up and down, pushing and pulling on the speaker diaphragm, vibrating the air in front of the speaker, and creating sound waves.

A UV curable adhesive is used to join the voice coil to the diaphragm. The diaphragm for micro speakers is most often made of mylar, paper or metal. Mylar costs less and is easier to shape. When joining the voice coil to the thin diaphragm, care must be taken to avoid heating this delicate part during the curing process.

The OmniCure S2000 UV Spot Curing System has 5 different filter options to provide low heat curing. This allows the manufacturer to eliminate the spectrum of light which could be absorbed by the thin plastic diaphragm causing unwanted heating. The result is a rapid cure of the adhesive with no heating of the sensitive components.

A UV curable acrylate is often used to join the voice coil assembly to the spider. An important requirement for this bond is that the adhesives remain flexible in order to absorb vibrations. This is essential for ensuring optimum acoustic properties of the micro speakers.

When curing a UV acrylate, a very repeatable irradiance level must be maintained. While acrylates provide the benefit of curing very rapidly with UV exposure, it is also possible to over-cure them. This could have a detrimental effect on the physical properties of the cured adhesive such as reducing flexibility. This will result in inferior acoustical properties.



FIGURE 3: Micro speaker component such as diaphragm or voice coil

The OmniCure S2000 UV Spot Curing System prevents these problems with Closed-Loop Feedback technology. This proprietary technology constantly monitors the irradiance level of the UV spot curing system and maintains a very repeatable output. This ensures a repeatable manufacturing process of very high quality speakers.

Assembly of Micro Speaker Modules

The manufacturing of micro speakers for cell phones poses a challenge to provide strong bonding of different materials in a rapid, automated process. Sensitive components must be held together to withstand harsh conditions, yet must maintain flexibility in order to provide the acoustic properties demanded by consumers to enjoy the multimedia functions of their cell phones.

OmniCure technology offers unique benefits over and above standard UV curing, ensuring **repeatable** irradiance and **low heat curing** for optimal assembly of specialized electronic components such as cell phone speakers.

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, for consistently flexible bonds and optimum acoustic properties.
- The OmniCure S2000 has a choice of 5 different filter options to provide low heat curing for sensitive components.



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