Laser Processing of 3M™ Electrically Conductive Adhesive Transfer Tape 9703

- Smooth laser-processed edges and minimal heat-affected zones
- No degradation to the physical properties of the materials
- Eliminates material deformation during processing
- Consistently and repeatedly process 3M tape 9703 to a high degree of dimensional accuracy

PROCESSING EXAMPLE

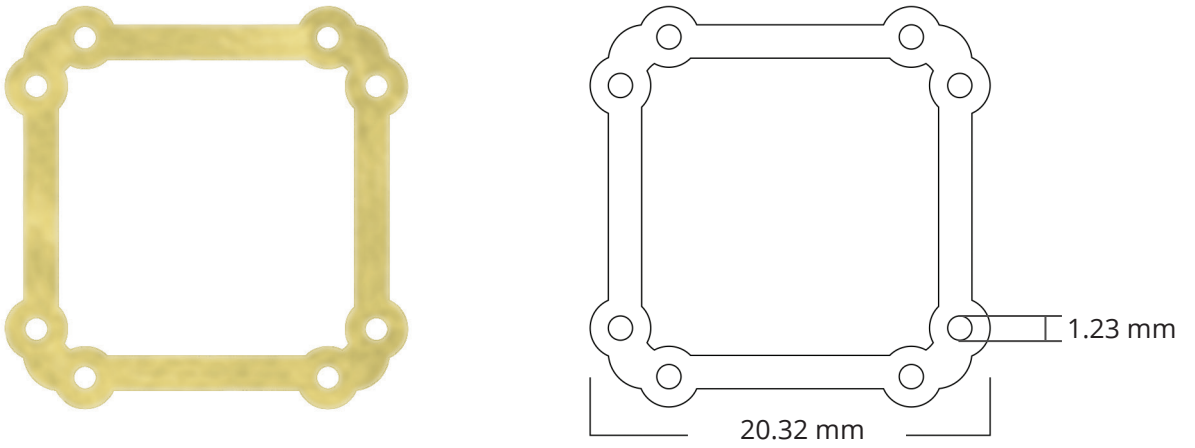

Figure 1. *Example of the fine geometry possible with laser processing 3M tape 9703.*

3M™ Electrically Conductive Adhesive Transfer Tape applications requiring fine geometry and intricate detail without degrading the physical properties of the material can be achieved with Universal Laser Systems technology. An example demonstrating the results of laser processing the 3M tape 9703 material is shown in ***Figure 1***.

MATERIAL OVERVIEW

3M™ Electrically Conductive Adhesive Transfer Tape 9703 (ECATT) is one of 3M's ECATTs also known as Conductive Pressure-Sensitive Adhesives (CPSAs) similar to 9707, 9709SL, 9712, 9713 and 9719. 3M tape 9703 is a Z-axis (anisotropic) electrically conductive CPSA filled with silver conductive particles. The high volume of silver particles gives the tape basic thermal performance and excellent confirmability. The material is low outgassing and typically used to electrically connect EMI/RFI shields to metal frames and enclosures. 3M tape 9703 is available with a 50µm filled acrylate adhesive layer and a 100µm silicone-treated polycraft release liner on the bottom surface. A diagram depicting the layers of the 9703 material is shown in ***Figure 2***.

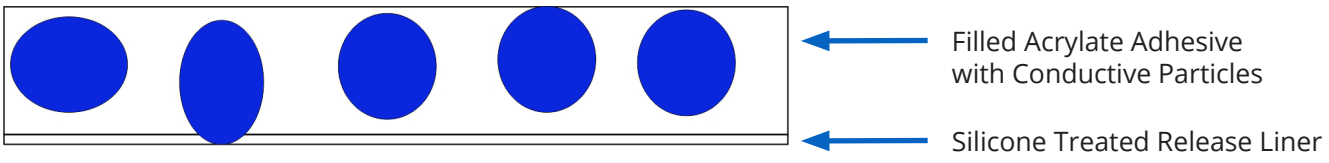

Figure 2. *3M tape 9703 diagram showing the 50µm PSA matrix filled with conductive particles and the 100µm silicone treated release liner.*

3M ECATT materials are flexible adhesive transfer tapes. The delicate nature of these materials makes them difficult to process with possible deformation when processed with traditional mechanical methods. The non-contact nature of laser processing overcomes this difficulty, which enables the processing of applications with fine geometry and intricate detail. Universal Laser Systems makes it simple to consistently and repeatedly process these materials.

LASER PROCESSING NOTES

3M tape 9703 was tested to assess laser processing compatibility and determine the best system configuration of laser peak power and wavelength. The filled acrylate matrix absorbs 9.3µm energy more efficiently than other wavelengths, meaning less peak power was necessary to produce good results with minimum heat effects. The silicone-treated polycraft release liner also absorbs the 9.3µm wavelength efficiently with nominal heat effects along the processed path. Microscopy images taken at 200X magnification of the processed edge of the 3M tape 9703 post-processing with the release liner in place and the liner removed are shown in ***Figures 3*** and ***4***, respectively. In these images, the material is shown to be relatively free of heat effects and discoloration. Further inspection of the laser-processed material shows that the acrylate adhesive layer is cleanly processed along the processed path with the 30 watt 9.3µm CO_2 laser source.

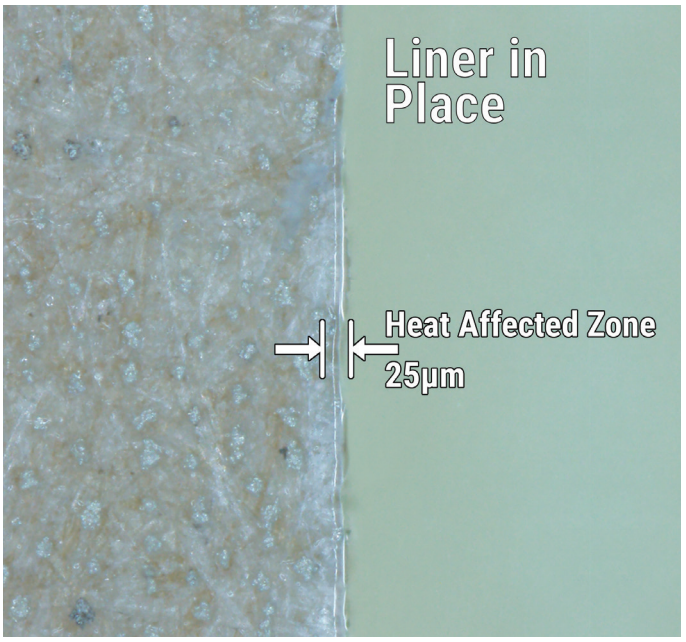

Figure 3. *Microscopy image (200X) of the laser-processed edge of 3M tape 9703 with the silicone-treated release liner in place. The heat-affected zone measures 25µm.*

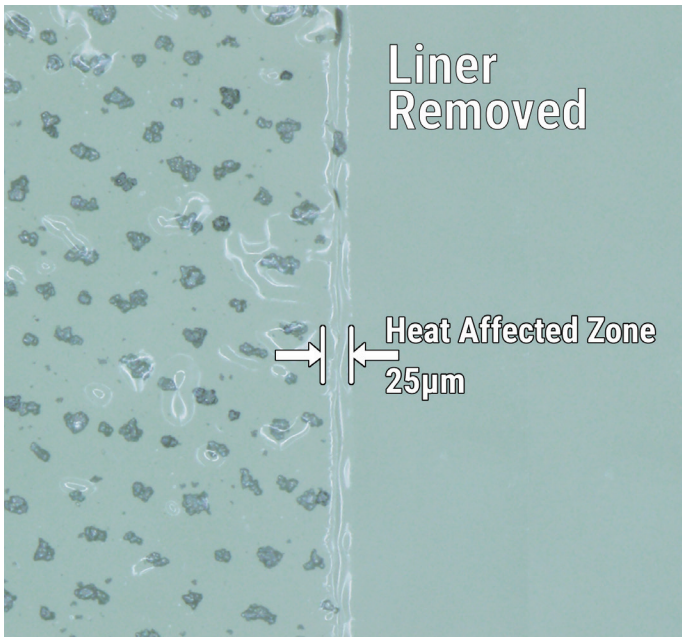

Figure 4. *Microscopy image (200X) of the laser-processed edge of 3M tape 9703 with the liner removed from the material post-processing. The heat-affected zone measures 25µm.*

ALTERNATIVE SYSTEM CONFIGURATION ANALYSIS

3M tape 9703 was also tested with an alternate system configuration of 10.6µm laser energy at an equivalent laser power level for comparison and determination of the effectiveness of each system configuration. The results of these tests were compared by analyzing the heat effects, quality of the processed edge, and post-processing requirements. The results of the comparison of these system configurations are listed in tabular form in ***Table 1*** and shown photographically in ***Figure 5***. Both system configurations appear viable with some reduction in quality of the results for the 10.6µm configuration as stated in the comparison.

Table 1. System Configuration Comparison

System Configuration	Heat-Affected Zone	Process Characteristics	Post-Processing Requirements
9.3µm (strongly recommended)	Minimal heat-affected zone of approximately 25µm.	The 9.3µm laser energy has the advantage of better absorption by the material resulting in a consistent edge along the processed path with a reduced heat-affected zone.	Processing of the 3M tape 9703 material with either the 9.3µm or the 10.6µm configuration did not require additional post-processing.
10.6µm	Increased heat-affected zone compared to 9.3µm wavelength of approximately 68µm.	This configuration results in an increased heat-affected zone in the adhesive layer when compared to the 9.3µm configuration.	

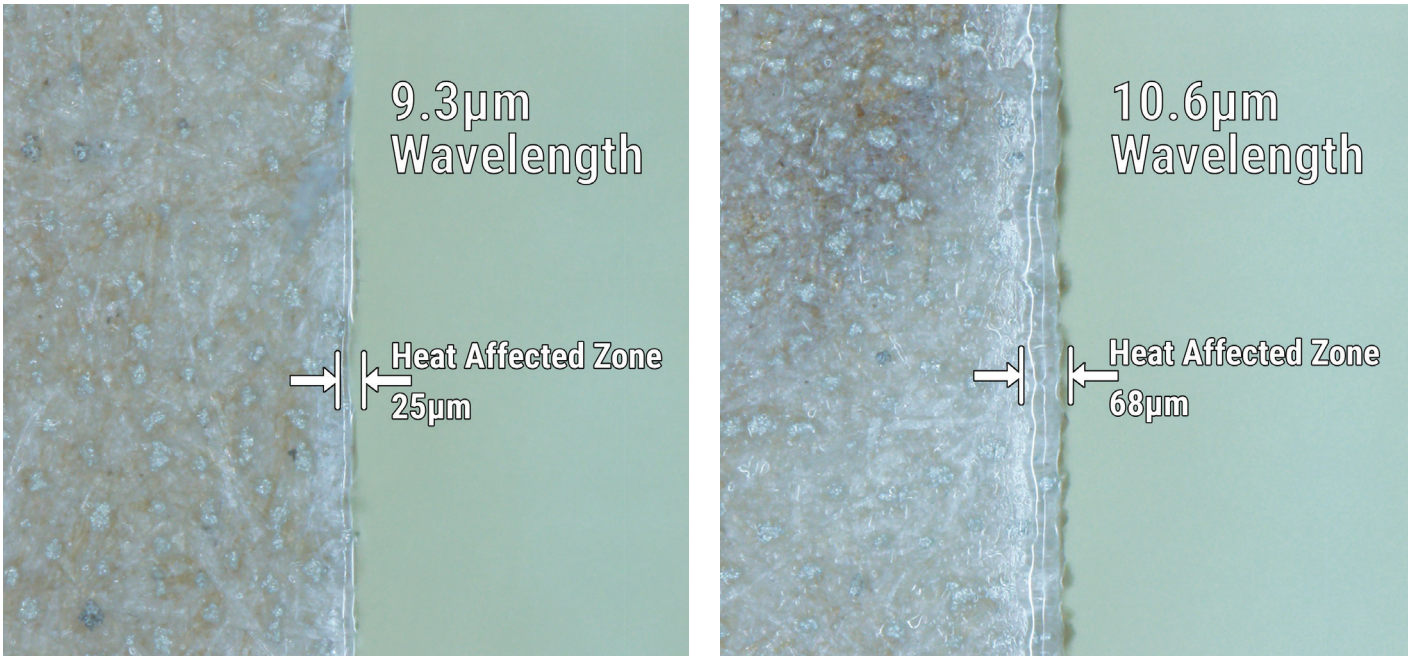

Figure 5. *Comparison microscopy images (200X) of the processed edge resulting from 9.3µm processing (left), and 10.6µm processing (right). The silicone treated release liners were left in place for both samples.*

CONCLUSION

3M tape 9703 is very well suited for laser processing and was extensively tested to determine the most efficient processing configuration. Through this testing it was determined that laser processing is viable with this material, and a 30 watt 9.3µm CO_2 laser source is the best configuration of wavelength and power for the processing of this material. The silicone-treated polycraft liners and acrylate adhesive layer efficiently absorb the 9.3µm wavelength laser energy and, coupled with the peak power of the 30 watt laser source, produce a clean smooth processed edge that has minimal heat-affected zone and discoloration.

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