Laser Processing of 3M™ Electrically Conductive Adhesive Transfer Tape 9719

- 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 9719 to a high degree of dimensional accuracy

PROCESSING EXAMPLE

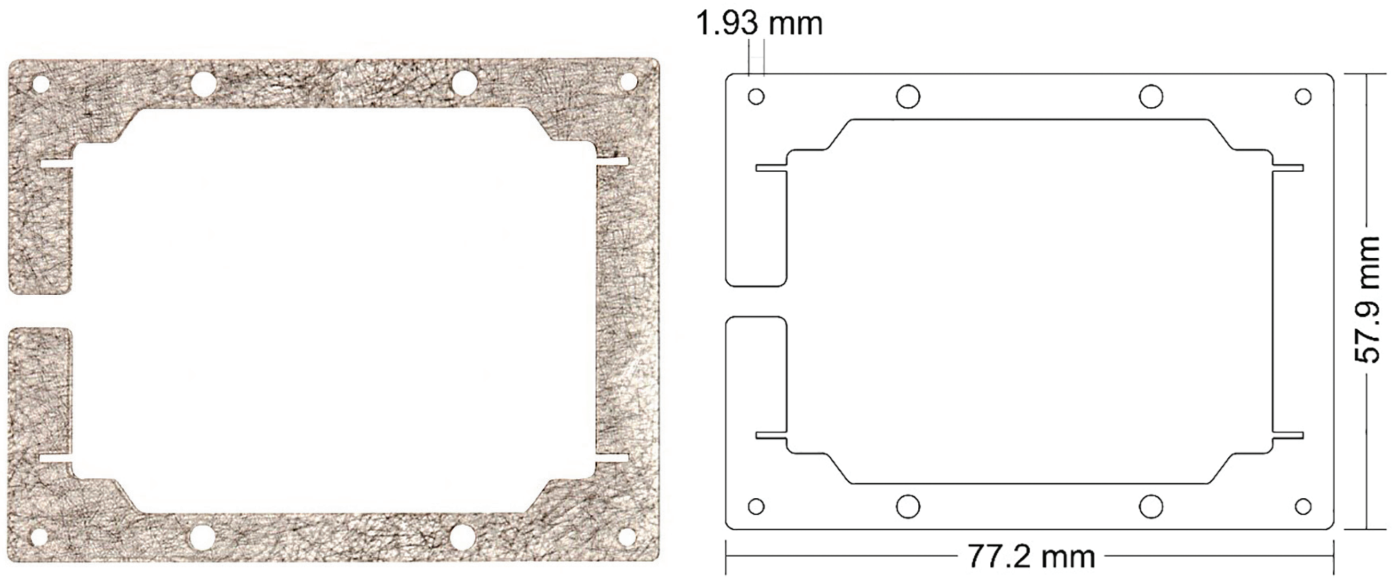

Figure 1. *Example of the fine geometry possible with laser processing 3M tape 9719.*

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 9719 material is shown in ***Figure 1***.

MATERIAL OVERVIEW

3M Electrically Conductive Adhesive Transfer Tape 9719 (ECATT) is one of 3M's ECATTs also known as Conductive Pressure-Sensitive Adhesives (CPSAs) similar to 9703, 9707, 9709SL, 9712, and 9713. 3M tape 9719 has a 100µm silicone adhesive layer with a conductive nonwoven carrier filled with nickel and carbon fibers. The conductive fibers allow electrical continuity between substrates through the silicone adhesive layer and additionally, provide electrical continuity through the thickness (Z-axis) and in the plane of the adhesive (X-Y planes). The silicone adhesive layer itself is protected with 50µm thick PET release liners on both the top and bottom surfaces. A diagram depicting the layers of the 9719 material is shown in ***Figure 1***.

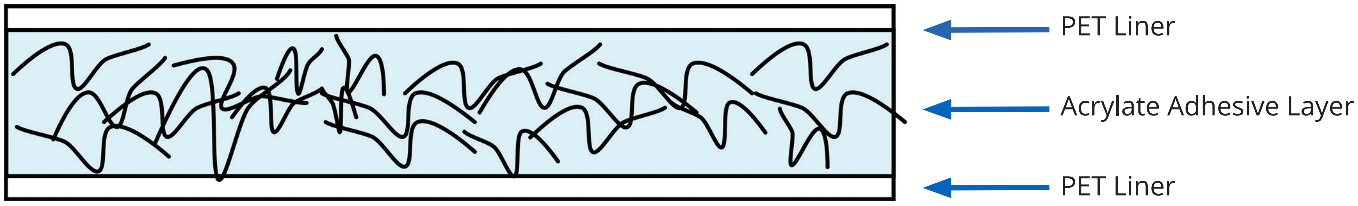

Figure 2. *3M tape 9719 diagram showing PET liners located on top and bottom of the silicone adhesive layer. PET layers measure 50µm thick and the silicone adhesive layer measures 100µm thick.*

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 9719 was tested to assess laser processing compatibility and determine the best system configuration of laser peak power and wavelength. The PET liners absorb 9.3µm energy more efficiently than other wavelengths, meaning less peak power was necessary to produce good results with minimum heat effects. The silicone adhesive layer also absorbs the 9.3µm wavelength efficiently with clean edges free of heat effects with nominal oxidation to conductive filaments along the processed path. Microscopy images taken at 300X magnification of the processed edge of the 3M tape 9719 post-processing with the liners in place and the liners removed are shown in ***Figures 3*** and ***4***, respectively. In these images it is shown that the PET liners contain most of the heat effects and discoloration, while the silicone adhesive layer itself is relatively free of heat effects and discoloration.

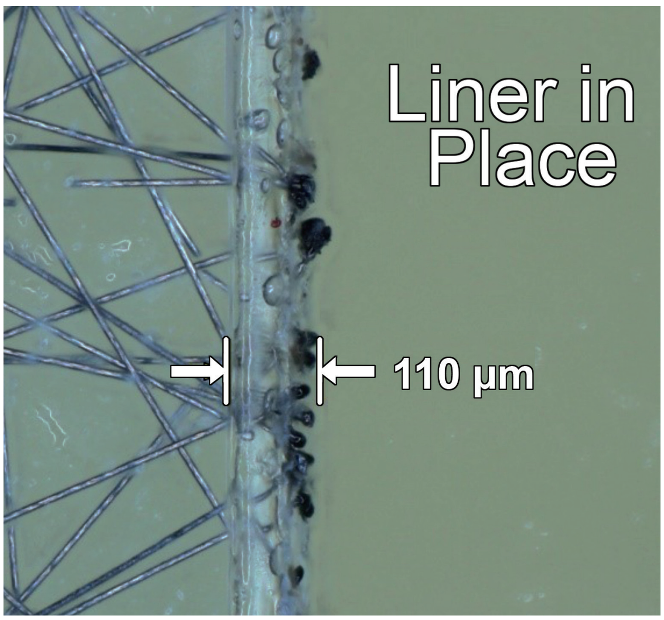

Figure 3. *Microscopy image (300X) of the laser-processed edge of 3M tape 9719 with the PET liners in place. The heat-affected zone measures 110µm.*

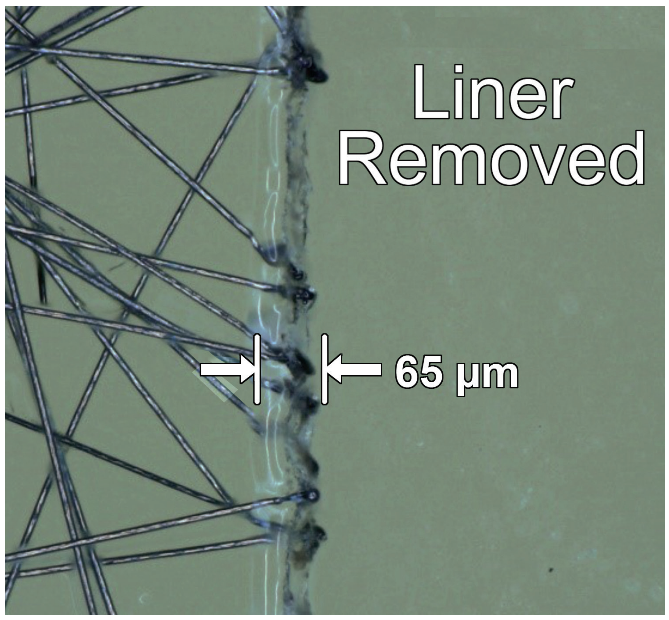

Figure 4. *Microscopy image (300X) of the laser-processed edge of 3M tape 9719 with the PET liners removed from the material post-processing. The heat-affected zone measures 65µm.*

Further inspection of the laser-processed material shows that the silicone adhesive layer is cleanly processed along the processed path with the 30 watt 9.3µm CO_2 laser source. ***Figures 3*** and ***4*** depict microscopy images of the processed surfaces and the resulting heat-affected zones of each wavelength.

Surface measurements of heat-affected zones of processed regions are shown in ***Figures 5*** and ***6***.

*The image in **Figure 5** below shows that the PET layer reacts to the laser energy by forming a "wave" of melted material along the top surface of the processed edge.*

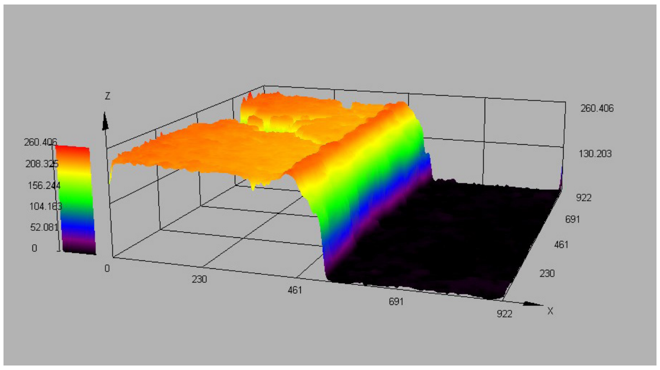

Figure 5. *3D-rendered microscopy image (300X) of the laser-processed edge of the 3M tape 9719 with the PET liners in place.*

*The image in **Figure 6** below shows the PET liners removed from the material, showing the smooth flat surface, free of adverse heat effects.*

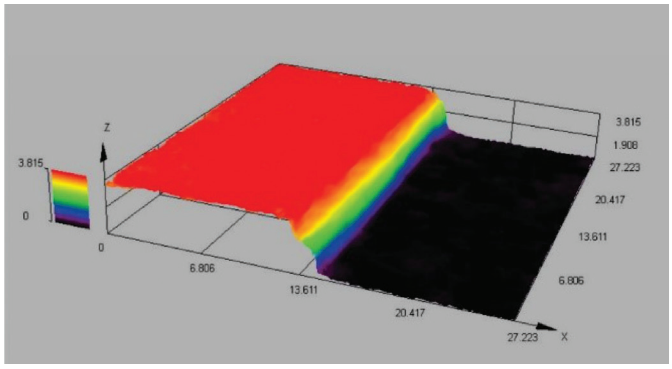

Figure 6. *3D-rendered microscopy image (300X) of the laser-processed edge of the 3M tape 9719 with the PET liners removed.*

ALTERNATIVE SYSTEM CONFIGURATION ANALYSIS

3M tape 9719 was also tested with an alternate system configuration of 10.6µm laser energy at 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 7***. 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 110µm.	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 9719 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 180µm.	This configuration results in an increased heat-affected zone in the PET liner and produces a rougher edge along the processed path in the adhesive layer when compared to the 9.3µm configuration.	

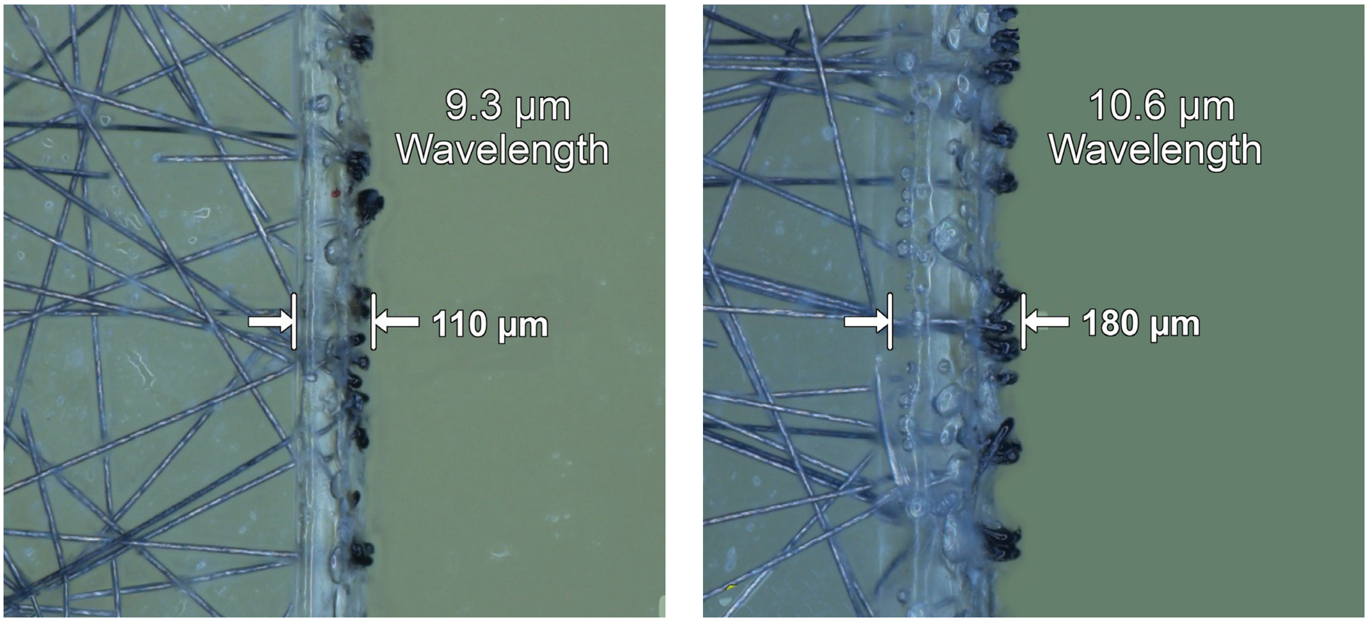

Figure 7. *Comparison microscopy images (300X) of the processed edge resulting from 9.3µm processing (left), and 10.6µm processing (right). The PET liners were left in place for both samples.*

CONCLUSION

3M tape 9719 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 PET liners and silicone 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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