Laser Processing of 3M™ Thermally Conductive Heat Spreading Tape 9876-15

- 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 9876 to a high degree of dimensional accuracy

PROCESSING EXAMPLE

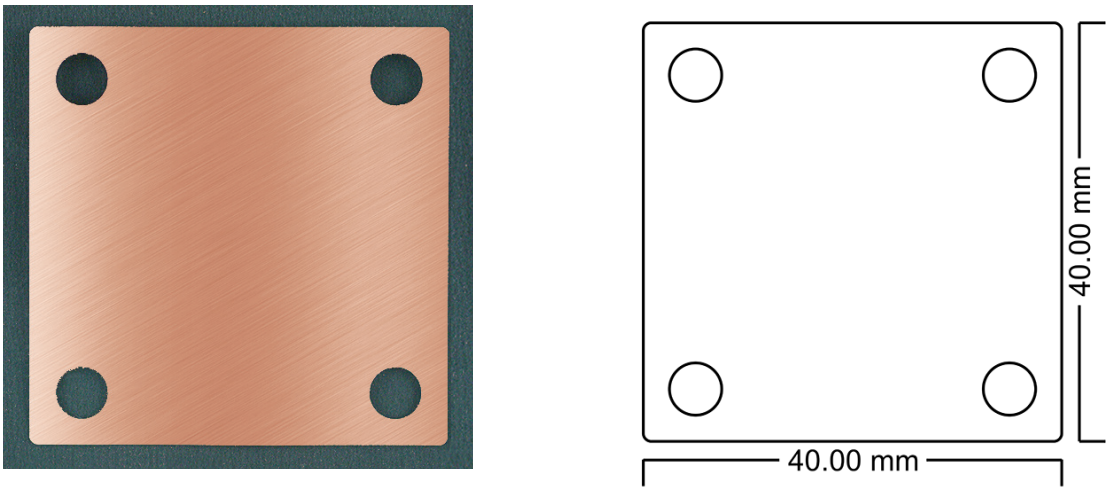

Figure 1. *3M tape 9876-15 diagram showing the polymeric coated thermally conductive heat spreading copper foil with acrylate adhesive and PET release liner. The 9876-15 is 150µm thick.*

3M™ Thermally Conductive Heat Spreading 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 9876-15 material is shown in ***Figure 1***.

MATERIAL OVERVIEW

3M™ Thermally Conductive Heat Spreading Tape 9876 is designed to provide excellent heat spreading performance on plane direction for stimulation of quick heat dissipation with a preferential heat-transfer path between heat-generating components and designated cooling devices (e.g., heat sink, fans, heat pipes and metal frame). Heat spreaders conduct to distribute thermal energy from a heat-generating component to another location where the heat can be removed through a heat dissipation mechanism. Focused on increasing the X-Y direction thermal conductivity to enhance heat spreading, 3M tape 9876 is designated to solve the limitation of existing products. 3M tape 9876 has a thin, permanent polymeric cover film that provides for electrical isolation to the heat spreading metal top surface, provides for easier handling of the 3M tape 9876 and reduces product deformation during handling. The 9876 product consists of a thermally conductive copper base

layer that is designed to increase thermal conductivity to enhance heat spreading in the X-Y plane and use a liner-covered high-performance acrylic PSA on the bottom side to provide excellent adhesion to many substrates. 3M 9876 series tapes are available in a range of compositions and thicknesses. 3M tapes 9876-10 and 9876-15 have copper-colored top sides in appearance and are available in thicknesses of 100µm and 150µm, respectively.

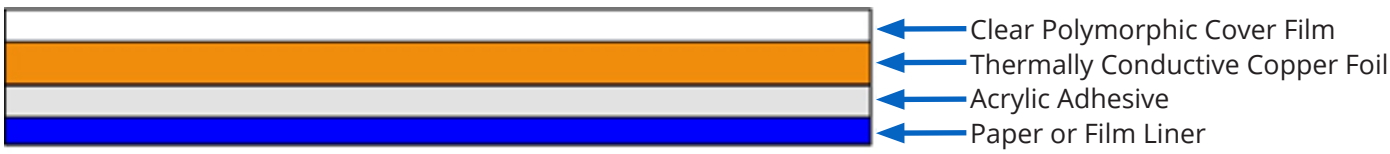

Figure 2. *3M tape 9876-15 product construction*

LASER PROCESSING NOTES

3M tape 9876-15 was tested to assess laser processing compatibility tested to assess laser processing compatibility and determine the best system configuration of laser peak power and wavelength. The 1.06µm fiber laser energy transmits through the clear polymeric top coat and is absorbed by the underlying copper foil. The thermal transfer from the interaction of the fiber laser with the copper foil transmits to both the acrylate adhesive and PET release liner to produce a clean processed edge with minimum heat effects across all layers of the material. Microscopy images taken at 69X magnification of the processed edge of the 3M tape 9876-15 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 acrylate adhesive layer shows nominal recession from the copper foil. Further inspection of the laser-processed material shows that the copper foil and acrylate adhesive layer are cleanly processed along the processed path with the 50 watt 1.06µm fiber laser source.

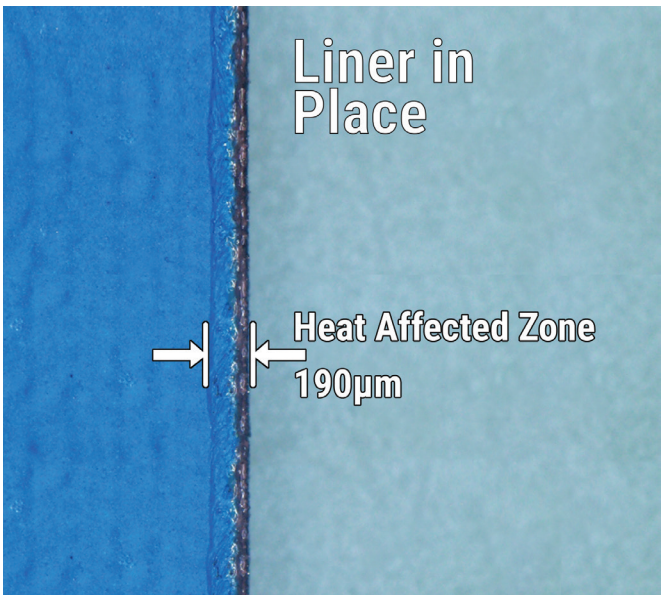

Figure 3. *Microscopy image (69X) of the laser processed edge of 3M tape 9876-15 with the PET liner in place. The heat-affected zone measures 190µm.*

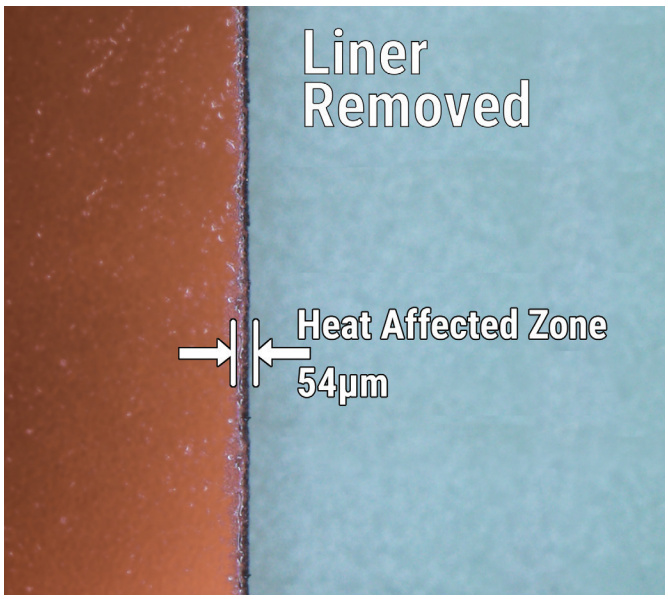

Figure 4. *Microscopy image (69X) of the laser processed edge of 3M tape 9876-15 with the PET liner in removed. The heat-affected zone measures 54µm.*

CONCLUSION

3M tape 9876-15 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 50 watt 1.06µm fiber laser source configuration is the best configuration of wavelength and power for the processing of this material. The 1.06µm fiber laser energy transmits through the clear polymeric top coat and is absorbed by the underlying copper foil. The thermal transfer from the interaction of the fiber laser with the copper foil transmits to both the acrylate adhesive and PET release liner to produce a clean processed edge that has a minimal heat-affected zone across all layers.

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