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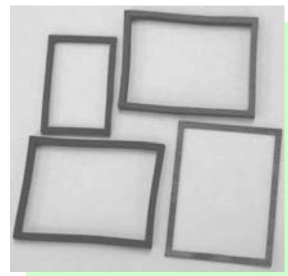
Technical Bulletin

Guidelines for CO_2 Laser Cutting of PORON® Urethanes and BISCO® Silicones



As laser cutting gaskets for prototyping becomes more common, there is a risk of product failure due to thermal and collateral damage caused by excessive laser energy. The purpose of this bulletin is to assist fabricators cutting Rogers High Performance Foams with CO_2 lasers by providing suggested settings and processing guidelines.

A variety of PORON® Urethane and BISCO® Silicone formulations were tested with a Diamond G-100 laser from Coherent Inc and compared to material processed with a steel rule die. At the recommended speed, fixed beam CO_2 with coaxial assist gas (clean dry air) yielded the cleanest processing. Tests were made using various combinations of pulse width, pulse repetition rate and power settings to determine operating parameters that yielded parts with optimum appearance. Scanning electron micrographs were taken of steel rule die cut parts and laser cut parts for comparison. Table 1 contains suggested operating parameters.

Operating Parameters for cutting PORON Urethanes and BISCO Silicones.

Material	Material Thickness (mm)	Pulse Width	Repetition Rate (HZ)	Table Speed (m/s)	Power (W)	Passes to cut Through	Time (sec)	Part Dimension (mm)
4790-92-12020-04P	0.50	20	260	5000	0.5	2	139	30x40
4701-15-06039-90P	1.00	20	260	5000	0.5	3	183	30x40
4790-92-12039-04P	1.00	25	260	5000	0.8	3	183	30x40
4790-92-25041-04P	1.04	25	260	5000	0.8	6	402	30x40
4701-30-20062-04	1.57	25	260	5000	0.8	6	313	20x30
4701-30-20125-04	3.18	35	260	5000	1.3	7	425	30x40
4701-40-20125-04	3.18	30	260	5000	1.1	12	742	30x40
4701-50-20125-04	3.18	30	260	5000	1.1	14	848	30x40
HT-6240	0.79	25	260	5000	0.8	12	300	10x20
HT-800 Black	1.59	30	260	5000	1.1	11	674	20x30
HT-800 Black	3.18	30	260	5000	1.1	21	1300	20x30
HT-805(A) Gray	1.59	50	260	5000	2.1	20	892	20x30
BF-1000 White	6.35	80	260	5000	4.0	25	704	10x20

PORON Urethane materials with thicknesses ranging from 0.5 mm – 3.18 mm were laser processed. Scanning electron micrographs show laser cut parts that appear very similar to the control or steel rule die cut parts. (See Fig. 1 - 6.) Lines, points and angles are maintained as seen at 30X magnification.

Overall it can be said these parts were successfully prepared using a laser. Fig. 2, 4 & 6 show a serrated edge, the result of sequential laser bursts, along the solid bottom layer. This uneven edge is only evident in the PET layer and will be seen with all PET supported PORON products. Although PORON materials can be processed at higher energy, serious thermal damage can result (See Fig 7). Therefore, it is recommended that low power settings be used at the expense of speed. Thicker materials were not evaluated, however based on the information here, greater power consumption, an increase in the number of passes and longer processing time is expected.

Figures 1-6 are scanning electron micrographs showing the comparative results of steel rule die vs. laser cutting techniques for select materials that were cut using the recommended settings as shown in the operating parameters table. Differences highlighted in the photos are not considered to be defects.

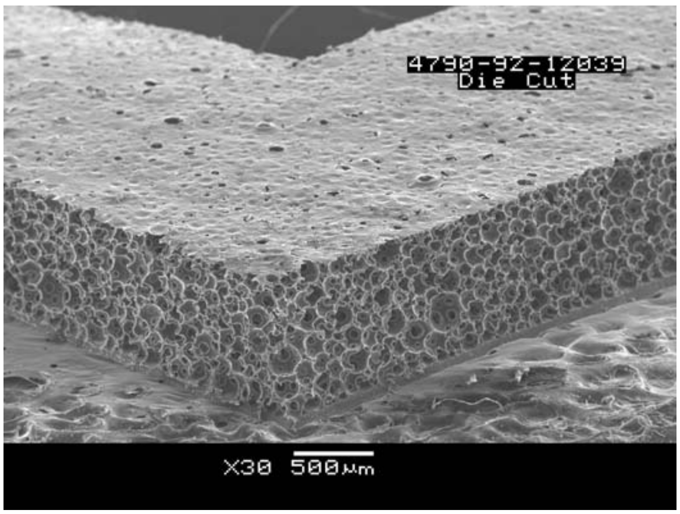


Fig. 1. PORON 4790-92-12039 Steel Rule

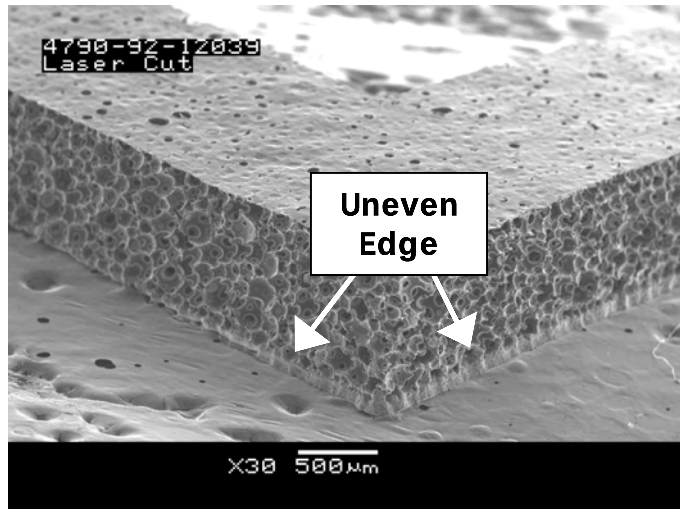


Fig. 2. PORON 4790-92-12039 Laser Process

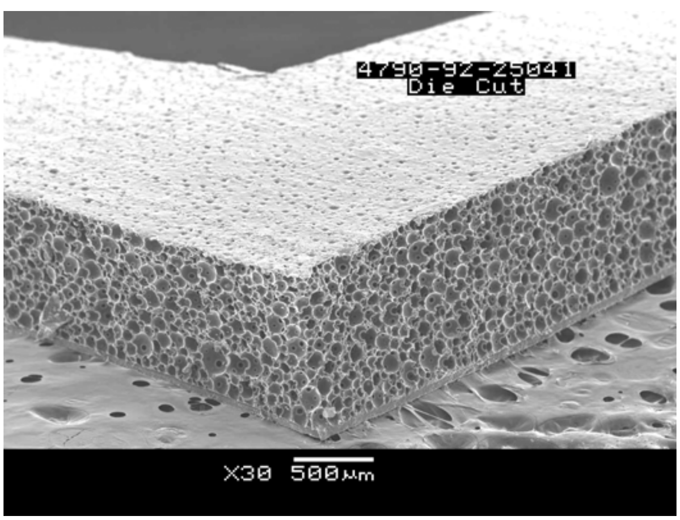


Fig. 3. PORON 4790-92-25041 Steel Rule Process

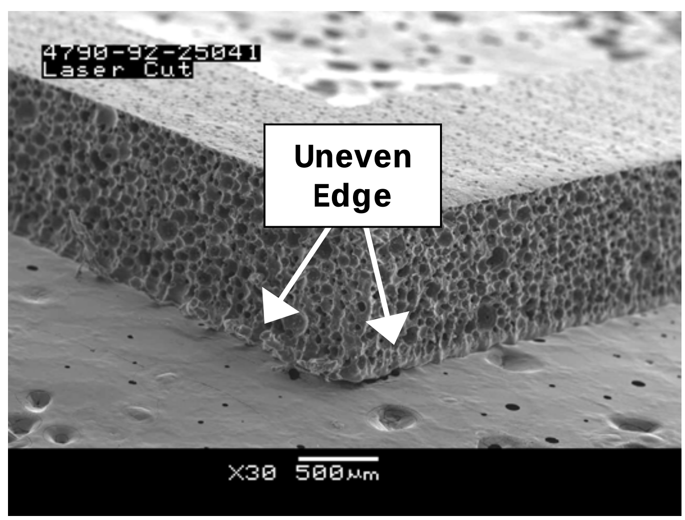


Fig. 4. PORON 4790-92-25041 Laser Process

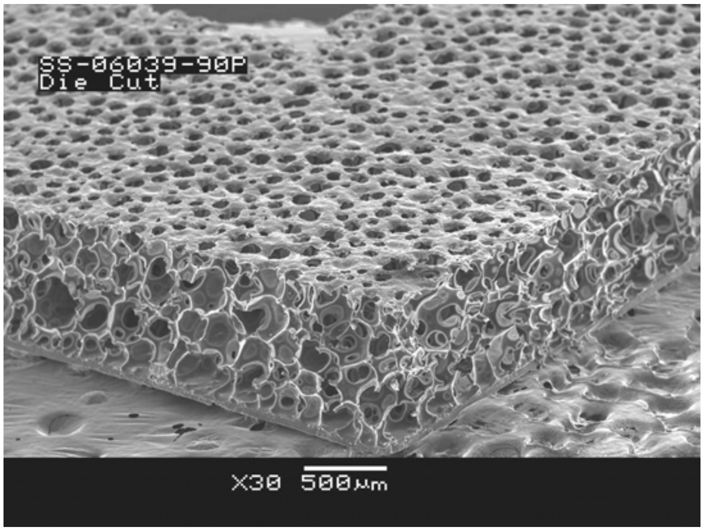


Fig. 5. PORON 4701-15-06039 Steel Rule Process

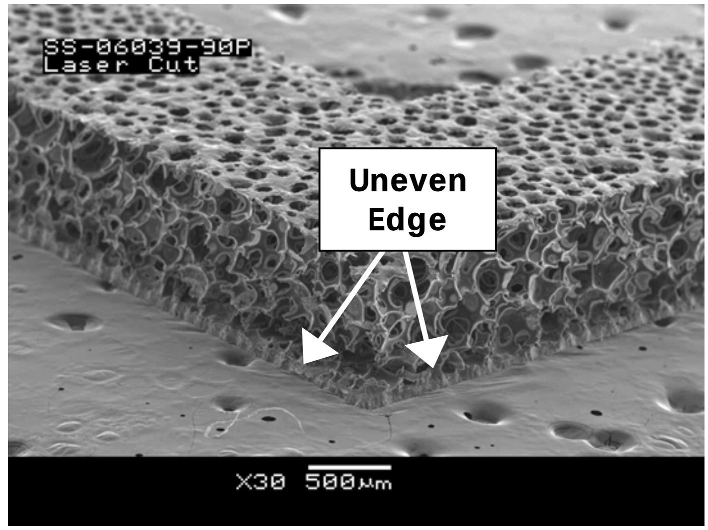


Fig. 6. PORON 4701-15-06039 Laser Process

Figure 7 shows the result of excessive energy. This represents a "worst case" situation showing severe thermal damage (region of burned material) to the PORON material.

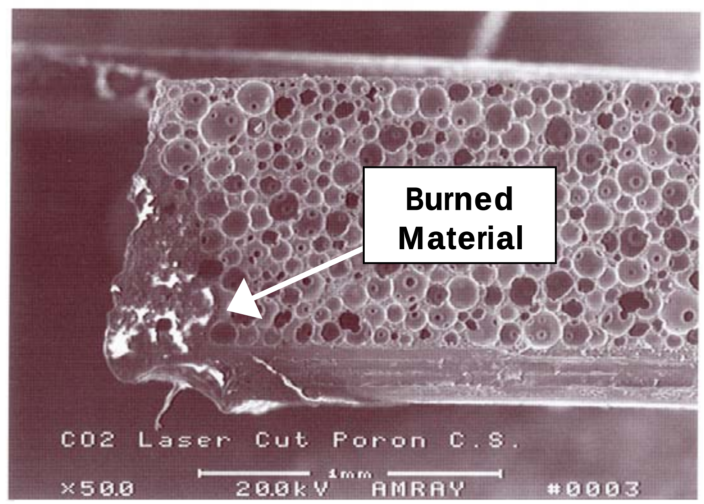


Fig. 7. Thermal Damage to PORON 4790-92-09039

BISCO Silicone materials were found to be less absorptive than PORON Urethanes, and therefore required longer dwell times. As a result, thermal damage was seen even with lower power settings. (See Fig. 8-9.) Materials ranging from 0.79 mm – 6.35 mm were evaluated.

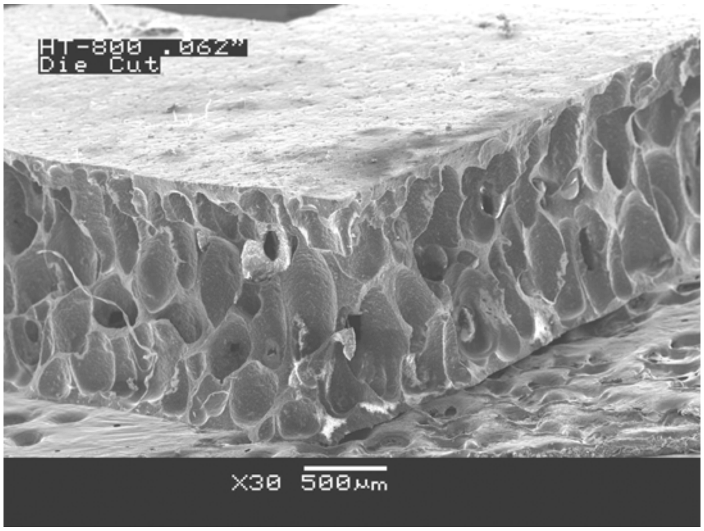


Fig. 8. BISCO HT-800 1.59mm Steel Rule Process

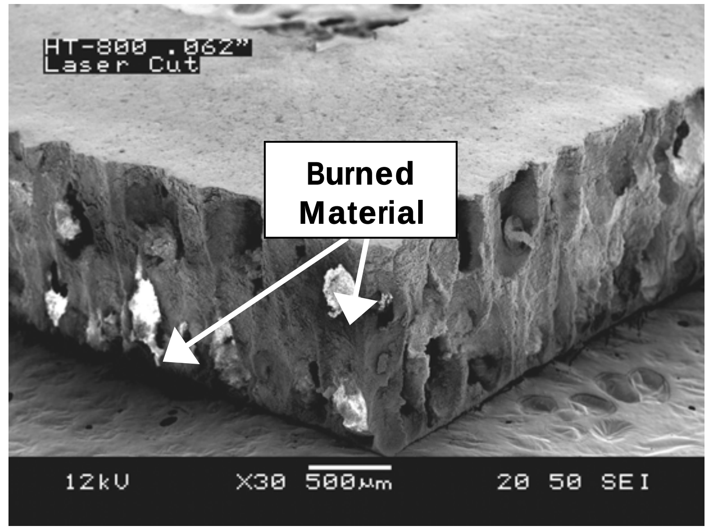


Fig. 9. BISCO HT-800 1.59 mm Laser Process

Other cuttings methods, such as steel rule die and water jet, are recommended with BISCO Silicone materials. While this document focuses on CO_2 lasers, an alternative laser form—UV—has been used to process silicones with improved results. Operating parameters for silicone materials have been included should the use of a CO_2 laser be necessary.

By following the suggested operating parameters provided in this technical bulletin, PORON Urethane materials can successfully processed using CO_2 lasers. For additional technical questions, contact the Rogers Solutions Center at (607) 786-8112.

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