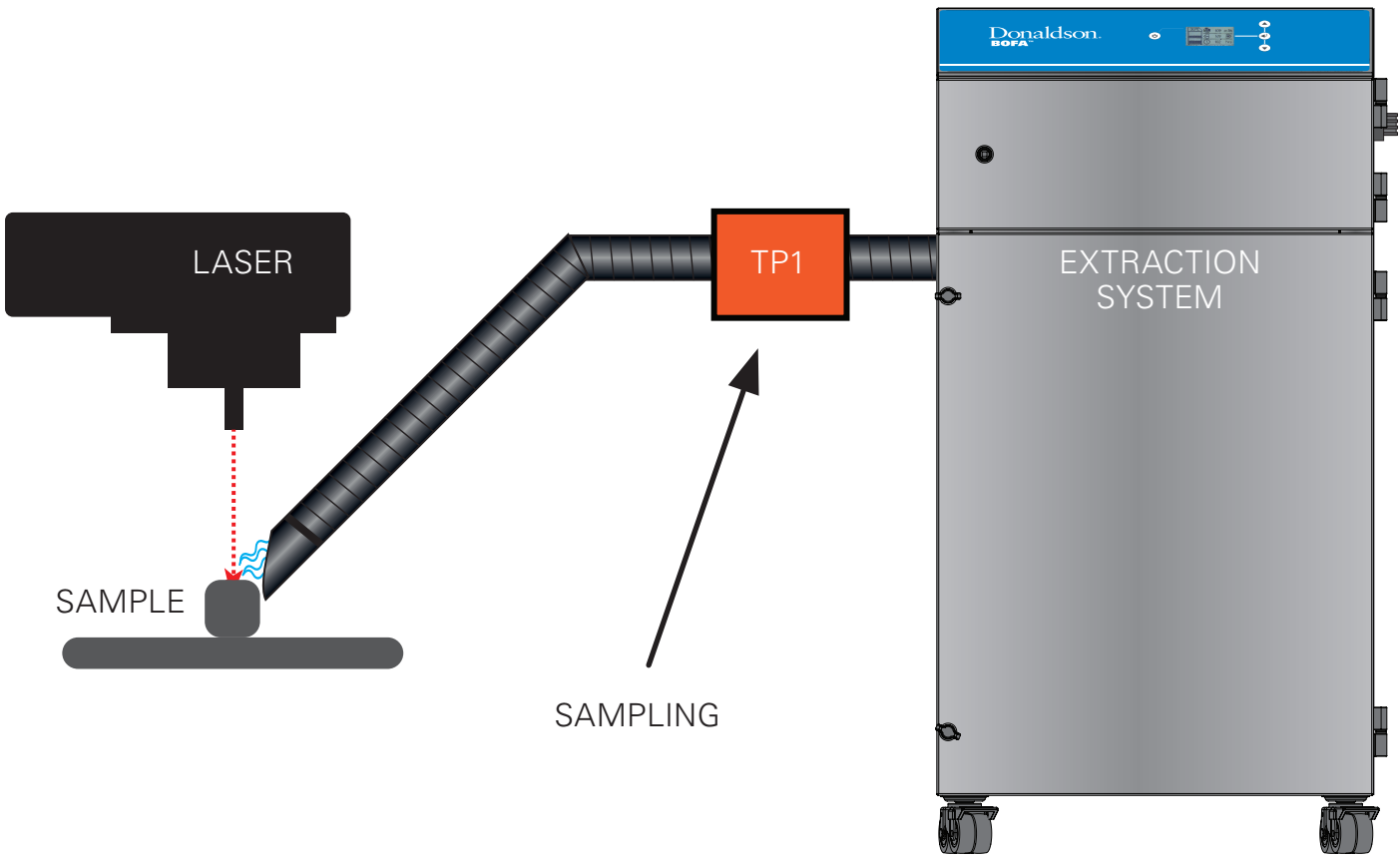


Donaldson®
BOFA™

UV Laser Emissions

LINX



UV Laser Emissions

Ultraviolet (UV) lasers are becoming increasingly popular within the laser coding market due to their precision and suitability for delicate materials. However, despite their growing use, there remains a widespread lack of awareness regarding the emissions generated during UV laser processing. UV lasers also cause a lower temperature at the point of ablation, which can lead users to believe that the emissions are less harmful. As a result, fume extraction is often overlooked or not prioritised in these applications.

To help educate the industry and close this knowledge gap, Donaldson BOFA partnered with Linx Printing Technologies to investigate the emissions produced during UV laser coding processes.

Material samples were marked with a UV, CO₂, or fibre laser. The fume was captured using a Donaldson BOFA fume extraction system. Before filtration, the particle concentrations were measured using a Trotec P200, and the VOC concentration was measured using a PhoCheck Tiger VOC meter.

The investigation involved UV laser processing of high-density polyethylene (HDPE), polypropylene (PP), steel, and aluminium. During these trials, both particulate and volatile organic compound (VOC) emissions were measured.

Key Findings

FIGURE 1

shows that the number of particles measured for each tested material was significantly higher than the background measurement across all particle sizes.

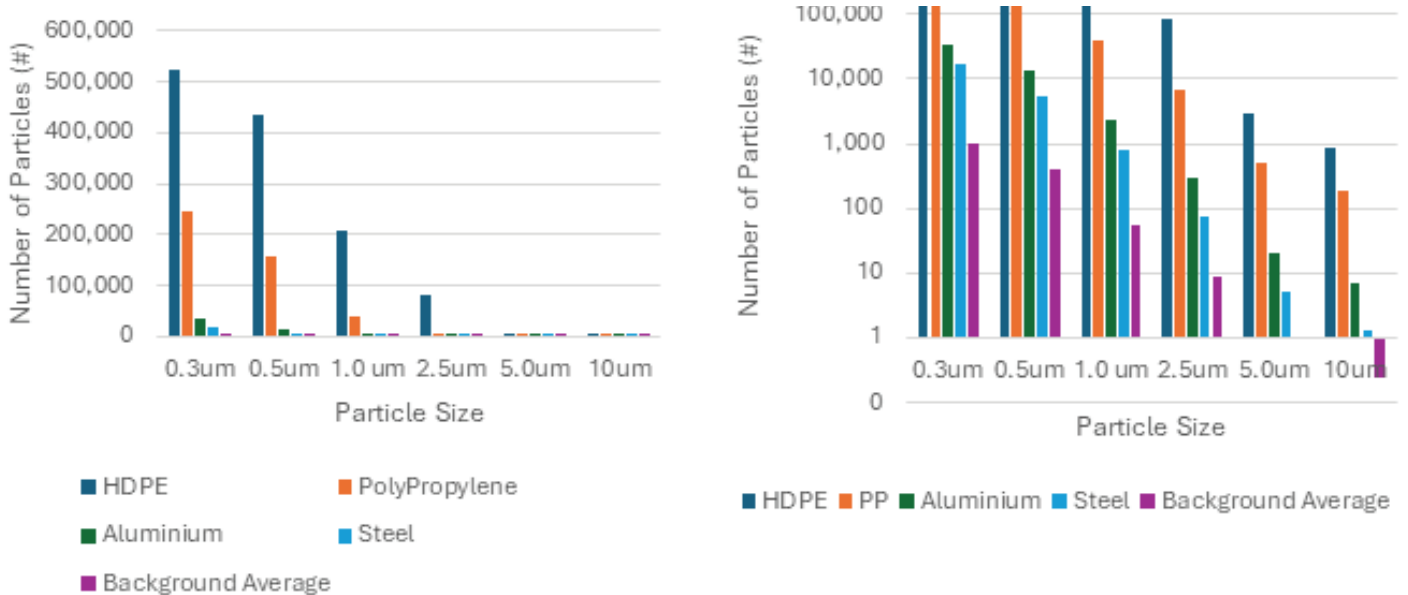


Figure 1: UV laser particle emissions for all tested materials compared to background readings. Shown both on an absolute scale (left) and a logarithmic scale (right).

FIGURE 2

shows that VOC concentrations were also notably higher than average background readings. As anticipated, steel and aluminium showed VOC levels similar to the background readings, as these materials do not decompose into VOCs (and so have not been included in the graph).

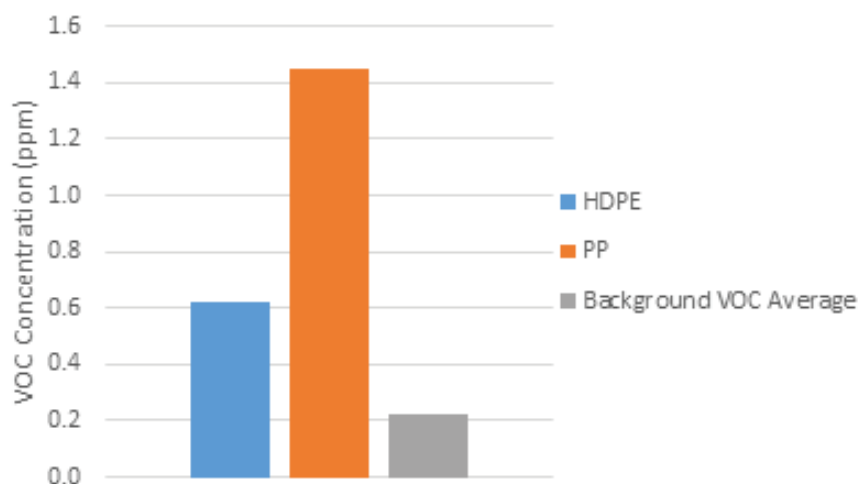


Figure 2: VOC readings for UV lasering HDPE and PP

The HDPE and PP were also laser processed using a CO₂ laser. As shown in **Figure 3**, UV laser processing resulted in smaller average particle sizes compared to the CO₂ laser. HDPE generated more particles at the smaller sizes of 0.3µm, 0.5 µm, 1.0 µm, and 2.5 µm.

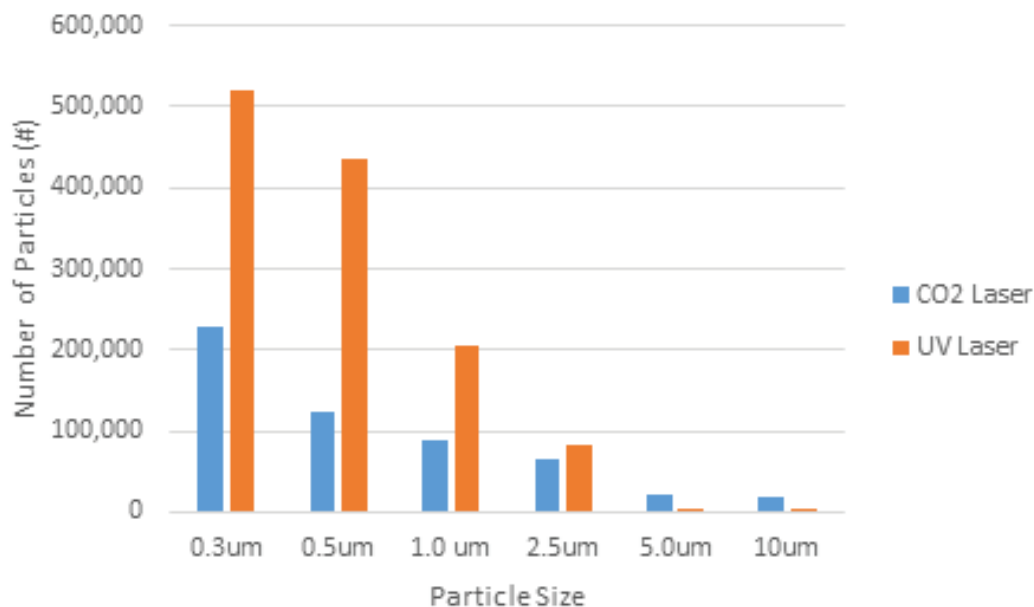


Figure 3: Particle emissions for HDPE for both CO₂ and UV lasers

These smaller particles can be considered more harmful due to the depth into the respiratory system they can potentially penetrate. Their low visibility to the naked eye may explain the misconception that fume extraction is not required on UV lasers.

Material removal rates were also recorded. The UV laser removed significantly less material than the CO₂ laser in both cases:

- **HDPE:**
 - UV laser removed 0.02g
 - CO₂ laser removed 0.2g
- **PP:**
 - UV laser removed 0.05g
 - CO₂ laser removed 0.06g

The VOC concentrations were also lower for the UV laser. During the HDPE experiment, the VOC concentration was 5.0ppm for CO₂ and 0.6ppm for UV. During the PP experiment, the VOC concentration was 3.7ppm for CO₂ and 1.5ppm for UV. However, it was not measured if the composition (i.e., what chemicals were generated) changed between the two laser types.

Conclusion

Overall, the particle and VOC measurements above the background readings indicate that users could benefit from the use of fume extraction on UV laser processes. As the UV laser removed less material than the CO₂ laser, users may benefit from longer filter life and a lower cost of ownership. The smaller particle size indicates that users would benefit from higher grade filters that are better suited to capture these smaller particles.

The testing conducted in this report has been undertaken by Donaldson and has not undergone third party/independent verification. This report does not constitute technical advice as there are very specific parameters utilized in the testing. For product specific advice, please contact the Donaldson BOFA technical team. Donaldson shall not be liable and takes no responsibility for reliance on this report.

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