# Steriolithography with pulsed UV laser

The advent of highly reliable, efficient, short pulse UV lasers has lead to their adoption in a wide variety of demanding processes. Attractions of UV processing include: high absorption in most materials; tighter focusing and 'cold' (photo-ablative) processing.

Recent advances in the design and manufacture of solid state UV lasers, such as the Coherent MATRIX have made these products more efficient and reliable than before. The MATRIX UV series are diode-pumped, solid-state, Q-switched lasers are available with output powers from 0.5 to 1.5 W at 355 nm, and a pulse width in the 10 to 30 nsec range.

One important application that benefits from short pulse UV lasers is stereolithography using a photopolymer resin. The laser generates a new layer by scanning its beam over a bath of the photopolymer, tracing out a cross section of the desired shape. Exposure to UV laser light causes the photopolymer to solidify and adhere to the layer below it. After a layer is traced, the part is lowered slightly in the photopolymer bath, and the laser traces the next layer. Finally, the completed part is cleaned in a chemical bath and cured in a UV oven.

Originally, stereolithography was used for rapid production of prototype parts, but over the past few years, advances in resin materials, the development of dual-spot writing technology, and the availability of more efficient and cost effective lasers like the MATRIX UV, have improved significantly the economics and mechanical properties of parts manufactured this way. As a result, this process is being increasingly used for small batch production of fully functional parts in applications such as medical, electrical, telecommunications, white goods, and even motor racing.

The maximum horizontal writing resolution and therefore the parts dimensional precision and surface roughness are directly dependent upon the laser beam quality and pointing stability. Power and pulse-to-pulse stability and control also directly impact surface quality. In the case of the MATRIX UV, the laser provides a nearly diffraction-limited, $TEM_{00}$ beam with excellent pointing stability and low noise, extreme reliability and lifetime. Its driver concept allows the complete control over every pulse. This results, for example, in an effective first-pulse suppression or a pulse-to-pulse adjustment to the acceleration/deceleration phases of galvanometer scanners, coordinate tables, gantries etc. (which generate a relative movement between workpiece and laser beam). The process quality becomes homogeneous from the start point of a process trace (e.g. a cutting or scribing line) to its end.

courtesy Alphaform/ Feldkirchen

**Stereolithography has evolved from a rapid prototyping method to a process for producing actual, functional parts, such as this oil-catch-tank from a racing car as used at LeMans.**

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