Roundtable Q & A: Machining

Igor Lukash and Mike McCormick

In this month's "Roundtable Q&A," industry leaders provide insights on machining topics, including benefits of machining, use of lasers, and areas of growth for machined components.

Question 1: What benefits does machining offer over other component fabrication techniques?

Igor Lukash
Technical Director, Gateway Laser Services

Modern laser micromachinig has experienced enormous changes within the last 10 years based on new laser sources with high efficiency laser diode pumping and developments of fiber lasers as well as shorter pulsed lasers with high frequencies. Laser micromachining will be used in all industries as engineers learn the advantages of the process, comparing it to well established mechanical machining methods (such as EDM), micromolding, electroforming, and chemical etching.

Mike McCormick
Manager of Technology and Automation, Avicenna

Generally, machining offers the benefit of producing components that are far more precise, intricate, and geometrically challenging than can be produced by other fabrication techniques, such as casting, stamping, forming, and molding. Machining provides superior flexibility through adaptable set-ups and programmed automation, and offers cost avoidance with the elimination of molds, tools, and dies. Machining can suffer in comparison to other fabrication techniques when high volume, low cost component manufacturing is desired.

Question 2: How has the use of lasers enhanced the capabilities of machining services providers?

IL: Laser micromachining is a process of choice for the medical industry. The miniaturization of devices for medical implantation, high reliability and accuracy, new materials used in medical devices, and wide range of applications is what drives the requirements for new processes suitable for laser machining tasks. Laser micromachining in metals and ceramics is a thermal process that shaves small layers of material based on high ejection rates from localized areas within a very short period of time. Laser ablation of polymers has a different mechanism based on photochemical reaction causing the decomposition of organics. The ability to laser micromachine materials has revolutionized machining of the smallest parts with micron level accuracy. There are no limitations in material type (metals-alloys, ceramics, polymers-organics, composites, adhesives, etc.), in shape or form of parts (flat sheet, tubes of any shape, 3D machining), as well as multilayered materials (removal of one material from another selectively). Another field of machining is to fuse various materials together using the laser beam which is commonly know as laser welding.

MM: Laser machining combines the best aspects of a traditional multi-axis machining center and a precision wire-EDM while offering these combined benefits at high processing speeds. Lasers perform machining without making physical contact with the material they remove. This eliminates the need for machining lubricants and the concern that precision and repeatability will be lost as contact tooling begins to wear.

A laser’s precise, non-contact material removal ability allows for the machining of soft polymers from delicate substrates, such as insulated wire and thin-wall tubing. Many lasers can perform multiple machining operations, such as marking, etching, cutting, and welding, depending upon the materials with which they interact and their process parameters.

Question 3: In what areas are machined components seeing increased growth in medical device manufacturing?

IL: Laser micromachining is for those who must think small and very precise. Whether you Laser drill, cut, or weld; using Yag and Eximer technologies should be considered your method of choice for achieving the highest tolerance and precision when producing catheters, implants, filters, flow orifices, microholes, performs, etc.

MM: Two areas of medical device manufacturing where laser machined components are experiencing rapid acceptance and seeing increased growth are the polymer bodies of long term implantable pacing and stimulation leads and the polymer shafts and insulated wire assemblies of catheter systems that sense and transmit signals. In both cases, the quest to provide higher functioning devices in ever smaller formats has led medical device designers away from conventional machining and toward laser machining. Non-contact drilling and contouring of soft durometer multi-lumen tube bodies and sublimated removal of coating from hair-thin conductors achieves the desired machining effect while safeguarding substrate layers. Laser machining allows device OEMs to push the performance limits of their chosen polymer materials, and push the precision limits of the features that are machined in those materials.