Freedom in Material Selection with Machining

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Greg Thompson, VP of engineering at Sanmina Medical Division, was a part of the staff written article, "The Fine Art of Machining." He took time to present a full array of responses that were not able to be included in the article, so they are presented here.

Q: *What emerging materials are ideal for machining?*
Thompson: A wide variety of metals and plastics are fabricated using machining and employed in medical devices. One material that Sanmina finds particularly useful is Austentic stainless steel. Austentic stainless steel is desirable for medical applications due to its ease of fabrication, durability, and corrosion resistance.

Machining of ceramic materials is beginning to gain application in medical devices. This is useful for specialty sensors and transducers. Machining of ceramics can be economically beneficial for medical devices that are produced in smaller volumes.

Q: *How does machining stand-up vs. other component fabrication techniques for medical devices?*
Thompson: Very well as each fabrication process has its respective advantages and disadvantages. Machining remains the only fabrication process that is practical for certain component geometries.

Sanmina is employing some exciting technology combinations. For example, 3D printing of metal is now a commercially practical technology for medical devices. 3D printing is being employed for basic structure and form with the finished geometries and surfaces created by machining.

Q: *Is machining losing ground in use for medical device manufacturing?*
Thompson: Yes. Many components that have traditionally been fabricated using machining are now being fabricated using various 3D printing techniques and MIM (Metal Injection Molding) processes. Additionally Sanmina has been transitioning a number of precision optical components (lenses, etc.) that previously have been machined (ground) to now fabricate them using molded glass or plastic.

Q: *What common error do design engineers make when specifying for machined parts for medical devices?*
Thompson: Two areas that Sanmina focuses on to avoid errors are: a) Ensuring that we consider part resonances to avoid failures and stresses induced by machining resonance. b) Ensuring that tolerancing is appropriately specified to avoid unnecessarily increasing the machining cost.

Q: *What unique capabilities/functionality do machined components offer to design engineers?*
Thompson: Machining offers freedom in material selection that cannot be obtained with other fabrication methods. Machining also facilitates rapid implementation of design changes affecting the geometry and material.

Q: *For what device sector (besides orthopedic implants) is machining being most often specified?*
Thompson: Machining is frequently used for secondary processes in conjunction with other fabrication methods to provide the tolerances and surface geometries required for precision applications. However, this is not device sector specific.

One area of interest to note is that it is common for the custom automated assembly equipment required to assemble, calibrate and test medical devices to often require higher levels of precision than the components fabricated for use in the medical device. Within Sanmina, precision machining is in high demand for the fabrication of the assembly, calibration, and test equipment needed to produce complex medical devices. This is most notable in assembly equipment used for alignment and calibration of optical subassemblies that are used in medical devices.

Q: *Has micro-machining offered "new life" for machined components for medical devices?*
Thompson: Yes, micro parts with precision of better than 0.01 microns are currently practical. This enables smaller manufactured products opening up new possibilities for implantable devices or replacements for certain anatomical structures.

Q: *Where is machining for the medical device industry headed?*
Thompson: Further advances are expected in the precision of the machining equipment along with wider deployment of more compact and lower cost machining equipment. As the cost and the size of the machining equipment are reduced, we expect to see more product assembly lines that include in-line or co-located machining operations as an integral part of the medical device manufacturing and assembly process. Sanmina has already been engaged in this model for more than a decade for large scale medical systems such as gantries for imaging systems. We expect this model to scale for smaller medical devices as the cost and size of the machining equipment decreases.