Technology

Meeting the Medical Machining Challenge: 5 Smart Tactics You Need to Know About

Kip Hanson | Oct 20, 2020

Working with challenging medical-grade materials such as titanium, cobalt chrome or stainless-steel alloys requires smart techniques. Here's what you need to know about precision medical machining.

Medical companies are continually developing new orthopedic implants from difficult and often proprietary alloys. From bone screws to hip replacement parts, these implants can be challenging projects for machinists. Geometries are often complex and tolerances can be tight.

The good news is that cutting tool manufacturers are keeping pace with these grueling demands by developing bold new insert geometries, tough but wear-resistant carbide grades and super-lubricious coatings.

Read more: Good Vibrations: How to Optimize Your Machine Setups to Minimize Chatter

Here are five important tips for achieving effective metal removal and getting the most life out of your cutting tools when working with these materials:

1. Stay sharp: PVD-coated tools work best across the entire range of medical-grade alloys. Cutting tool providers have developed specific grades for most of these materials and you should take advantage of them, especially on long-running or repeat jobs. Don't settle for general-purpose carbide grades or coatings, and work with your suppliers to determine the best ways to machine any new material.

> **"Remember: Even the slightest amount of movement when hogging a block of cobalt chrome or titanium can spell disaster."**

2. Be aggressive: Cutting tool providers might recommend a more aggressive approach when machining operations aren't going well. That's because pushing the tool harder often improves chip formation, and higher spindle speeds get more heat into the cut, reducing built-up edge (BUE)—a glob of metal that sticks to the top of the tool and usually chips the cutting edge when it breaks away.

3. Embrace trochoidal milling: Light depths of cut at higher feed rates are typically more effective than traditional "hogging" approaches to metal removal. Trochoidal toolpaths with full-length (Z-axis)

engagement are preferred. Arc in and out of the cut whenever possible. Avoid burying the tool in the corner. Program a radius slightly larger than that of the tool, and come back with a smaller tool to pick out the corners.

Read more: 5 Ways Manufacturers Can Use Data Analytics to Improve Efficiency

4. Stay true (and rigid): Rigid setups are doubly important when working with difficult materials. Avoid tool runout by ditching side-lock toolholders in favor of heat-shrink or hydraulic toolholders. Keep tools as short as possible, and look at replacing mechanical vises and chucks with their hydraulic or pneumatic cousins. Back-taper chuck jaws slightly, and use knife-edge vise jaws to increase grip. Remember: Even the slightest amount of movement when hogging a block of cobalt chrome or titanium can spell disaster.

5. Be positive: Most PVD-coated and precision ground tools have "up sharp" cutting edges. Great, but a positive lead-angle on the tool is also advantageous—such as the unused side of an 80-degree diamond or a round insert if feasible. This will reduce depth-of-cut notching, but it often forces you to circle back with a tool able to machine the corner square. Still, it might be well worth it, particularly when turning some super-tough nickel alloy or Grade 5 titanium.

And don't forget …

- When cutting metals high in chrome, nickel or cobalt, using tired or ill-maintained cutting fluidleads to poor tool life and unpredictable results.
- If you're struggling with coated carbide, it might be time to "go naked." ***Uncoated inserts*** often produce better results with superalloys, especially in finishing cuts.

What techniques can you share about working with challenging materials? Let us know in the comments below.

www.mscdirect.com/betterMRO