Industry Briefs

A NEW APPROACH TO CUTTING HEAT-RESISTANT SUPERALLOYS: Imagine machining Inconel 718 and similar heat-resistant superalloys (HRSAs) at cutting speeds normally reserved for aluminum. Melissa Singher, se-nior product coordinator for NTK Cutting Tools U.S.A., Wixom, Mich., said this improbable task is not only possible but becoming an accepted practice at some aerospace OEMs.

The secret is the toolmaker's SX9 ceramic endmills, according to Singher. "When machining superalloys, such as Inco 718 and 625, using SX9 endmills, you will typically use speeds of 2,000 to 3,000 sfm, with a mini-mum speed of about 1,000 sfm," Singher said. "As an example, a ½" endmill requires a minimum of 8,000 rpm and, for optimum performance, should be run in the range of 15,000 to 20,000 rpm. Feed rates will typically range from 0.0011 to 0.0013 ipt, or more than 100 ipm for a 4-flute endmill at 20,000 rpm."

NTK Cutting Tools U.S.A.

Dust follows the SX9 endmill from NTK Cutting Tools as it cuts a workpiece made from a heat-resistant superalloy.

At first glance, machining with one of these tools might have you running for the fire extinguisher. But what appears to be a glowing mass of chips that will soon ignite and a cutter that will soon be ready for the recycling bin is really an efficient metal-removal process, one that—applied correctly—offers tool life of 10 to 25 minutes, Singher said. She explained that SX9 is a SiAlON, or silicon-alumina nitride, ceramic that blends the strength of silicon nitride with the heat and wear resistance of alumina oxide. The cutting edge was reportedly developed to withstand the extreme heat and pressure generated when machining HRSAs at high cutting speeds.

Workhardening is common under such high cutting-speed conditions, which is why the endmills are mainly used for roughing. A finishing pass with a carbide endmill at least 0.3mm (0.012") in diameter is typically needed, Singher added.

Some additional rules of thumb for SiAlON endmills:

- Climb cutting is always recommended.
- Because of the high temperatures involved, continuous toolpaths reduce thermal shock to the tool.
- To cut internal pockets, ramp in at a 1.5° angle and feed 50 percent slower than normal.
- Ceramic endmills are not suitable for machining titanium because the heat generated reacts unfavorably with this material.
- Apply 6-flute endmills instead of 4-flute tools whenever possible to maximize productivity.

In addition, select high-speed, balanced hydraulic or shrink-fit chucks or arbors. Cutting fluid must not be used; instead, blast air directly at the chuck body to prevent expansion because of the tremendous heat generated during machining.

Lastly, don't be surprised at the price tag. Ceramic endmills sell for a much higher price than high-qual-ity carbide ones, but the greater throughput easily justifies the added cost.

Singher said, "Due to the highly competitive atmosphere in the engine component industry, we see great interest in this product from Tier 1 and Tier 2 subcontractors. These companies truly see the po-tential of productivity 15 to 40 times that offered by carbide endmills, re-sulting in major reductions in manufacturing time on complex HRSA components."

see complete article

—Kip Hanson