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SHOP SOLUTIONS

Inserts Help Shop Eliminate Grinding

Precision Rolled Products Inc. (PRP), a company of Krupp VDM GmbH, always looks for ways to expand its capabilities for supplying quality titanium and superalloy bar product to its aerospace customers. The company's recent addition of a second bar-peeling machine, and the support of cutting-tool supplier Sandvik Coromant (Fair Lawn, NJ), helped PRP achieve a 70% improvement in surface-finish quality for bars peeled using the new bar turner, which uses Sandvik inserts.

The change enabled PRP to eliminate centerless grinding for a significant portion of the company's Ti-6AL-4V bar production, saving time, labor, and materials. According to Brian Salego, production manager at the company's Reno, NV-based plant, PRP acquired its latest machine to increase its size-range capability for peeled bars.

"Soon after the bar peeler became operational, I contacted several cutting-tool suppliers asking for inserts to test," Salego recalls. "I wanted to determine what degree of improvement in surface finish could be achieved with this machine."

In the past, PRP used bar peeling exclusively as a rough-turning operation for its titanium and nickel-based alloy bars prior to finishing by centerless grinding. Round bars are primarily used in the manufacture of parts for jet engines, land-based gas turbines, and petrochemical and medical-implant applications.

Customer requirements for reforge stock, stock for machining, and stock for fasteners specify a smooth 35-45 R_a, defect-free surface finish. Centerless grinding has been the only way to satisfy this requirement.With Sandvik's wiper inserts, PRP was able to supply bars with a fine 15 R_a surface finish using a faster and more cost-effective process. Many customers who purchase Ti6Al-4V bars from PRP are now able to accept them with a peeled finish.

Bar peeling, compared to conventional turning processes, provides high productivity and low production costs due to shorter throughput times. The cutting head rotates about the bar stock, circumferentially milling bars that are typically 10-12´ (3-3.7 m) long. The bars move axially through the machine. On the new bar turner, a roll-clamp feeding system pushes the bar from one end of the machine through the four cutting heads on the rotating headstock of the machine. On the opposite end of the machine, a second set of roll clamps pulls the bar through the rest of the headstock.

Salego initiated a program to investigate inserts in order to optimize the bar-peeling operation. "We did not experience satisfactory tool life with the first inserts we tried," he notes. "We decided it was time to identify inserts that would provide improved surface quality as well as longer life."

PRP initially achieved the best results using a coated cemented carbide grade insert (2015) from Sandvik. "We were getting long tool life with these inserts, but we were also getting a helical pattern 'ringing' on the bar surface," Salego says. More testing called for Sandvik Coromant to bring tooling from Sweden for testing on PRP's new machine, with Sandvik and PRP putting together a cassette toolholder featuring two coated carbide grades (2015 and 2035). Initial geometries included a Sandvik TNMX finishing insert and a new, engineered insert, the S-WNGX. The latter insert features a medium-roughing geometry specifically designed for bar peeling.

Indexing problems ruled out the TNMX insert. The S-WNGX, however provided surface-roughness improvements that nearly matched that of the grinding operation. Testing was expanded to include uncoated grades of the new insert.

All uncoated carbides exhibited good chip breaking characteristics. Tool life averaged from four to nine bars per insert during initial bar-peeling parameter development. Surface finish improved to 10-16 R_a during testing when using Sandvik's H10F cemented-carbide grade insert in the wiper geometry. During testing, peeled bars were sent to some of PRP's aerospace customers for assessment.

Today, PRP uses the uncoated, cemented-carbide H10F insert to bar-peel its titanium round bars and achieves surface finishes of 15 R_a. The 2135 grade was

selected for peeling nickel and cobalt based high-temperature alloys.

"The majority of PRP's round bar product still has a centerless-ground finish," says Salego. "We are now supplying some nickel-based alloy bar in the peeled condition, and hope to provide peeled bar for a larger portion of both our superalloy and titanium alloy round bar production in the future."