

TiTan X-Treme: record-breaking tooling for titanium

Cutting tool developer Technicut and toolholding specialist Nikken Kosakusho worked with the AMRC to prove that a new tooling system can achieve record-breaking rates of metal removal.



Technicut and Nikken worked together to develop optimised cutting systems for the high-speed machining of the toughest alloys.

Technicut's TiTan Rippa carbide cutter is designed to significantly increase the speed at which titanium alloys can be cut.

"The TiTan Rippa is designed to slot at depths of twice the tool diameter –conventional alternatives typically achieve half to one diameter," says Mark Kirby, technical director at Technicut. "It can produce four times greater metal removal rates, significantly reducing tooling costs per kilogram of material removed."

Initial tests of the tool found that it was almost too powerful for the other parts of the machine tool system. The extremely high cutting forces generated by the tool meant that its chuck literally couldn't keep hold of it – specifically, when the tool generated very high forces in the axial Z-direction.

Nikken's expertise in tool-holding technology meant they were a natural partner for solving the TiTan problem.



Nikken came up with a new design called the X-Treme, based on Nikken's established Multi-Lock range but incorporating a number of enhancements.

"The final X-Treme features a completely redesigned and sealed nose ring assembly, and a unique tool shank security system," says Steve Eckersall, group engineering manager for Nikken. "Researched, developed and tested in the UK – effectively a first for Nikken – it not only guarantees the exact positioning of the tool shank but also systematically eliminates any movement and pulling of the tool shank during cut."

To prove the new technology was up to the job, Technicut and Nikken made use of the high-performance machining capabilities of the AMRC. The new tooling system was tested using the AMRC's Starrag Heckert ZT1000 five-axis milling centre as well as a Starrag HEC1600 horizontal boring machine hosted at the Nuclear AMRC.

The new X-Treme Multi-Lock met all expectations, allowing the TiTan tool to cut aerospace-grade titanium 6-4 alloy at super-fast rates – removing metal at up to 267 cubic centimetres per minute.

“Being able to test our new tooling systems on the large-scale machining centres at the AMRC has allowed us to prove their value to the most demanding clients,” says Kirby. “Our membership has benefited us enormously – we have won new business and grown our workforce as a result of the collaborative research and networking opportunities here.”

The patented system is now in production, and being deployed at major titanium machine shops around the world. One aerospace manufacturer is using the new tooling combination to mill slots in several sizes of titanium engine fan disc, and has reduced cycle time for one part from 36 hours to around 11 hours. The stability offered by the X-Treme is also reducing tooling costs – only six milling tools now do the amount of machining that used to require over 30 tools.

Nikken is now developing the X-Treme for use with other hard-to-machine alloys, starting with Inconel.

Nikken is also investing in a new European research and development centre on the R-evolution development at the Advanced Manufacturing Park, next to the AMRC campus.

“Not only have Nikken been partners since the inception of the AMRC, we will also have a technical base on the park from next year,” says Eckersall. “This investment is based on successes from projects like X-Treme.”

