

Additive Manufacturing

## Lighter Weight - Heavy Gain: Additive Manufacturing

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**Challenge:** *Vibration and its consequences – slower production, poor surface finish and short tool life – often limit the performance of long milling tools.*

**Solution:** *Additive manufacturing offers a new way to reduce the weight of a milling cutter by 80 percent for significantly better performance and up to 200 percent increased productivity, in combination with the Silent Tools™ damping technology.*

✚The combination of complex component features with deep cavities in demanding materials is a typical milling challenge in aerospace and oil and gas applications. The long overhangs that these applications require often cause a bottleneck due to vibration problems and related performance issues.

Sandvik Additive Manufacturing, a new division established within the Sandvik Machining Solutions business area in 2017, has looked into new ways to tackle this challenge. The result, offered by Sandvik Coromant, is the new lightweight **CoroMill® 390 milling cutter** combined with dampened Silent Tools™ holders.

The main goal was to decrease the weight of the cutter to improve the performance at long overhangs. Several alternatives were available, such as using a lighter material or machining holes in the tool body, but additive manufacturing turned out to offer the optimal solution in this case.



The Silent Tools™ internal damping system consists of a heavy mass supported by rubber spring elements, which creates a counter action to induced vibrations and dramatically reduces them.

✚To maximize the damping effect in the adaptor and to reduce the vibrations as much as possible, the

main consideration is to minimize the mass between the damping mechanism and the cutting edge, and to have the cutting edge as close to the damper as possible. With the aid of additive manufacturing and the use of titanium, the new solution minimizes both the mass and the distance, thereby considerably increasing metal removal rates.

## Additive Manufacturing

Additive manufacturing is the joint term for technologies aimed at building 3D objects by adding consecutive layers of material on top of another. The ISO/ASTM 52900-15 industry standard defines seven basic types of additive manufacturing processes depending on the materials and process characteristics. The Sandvik Group has all relevant printing technologies for metals in-house.

Additive manufacturing is a superior technique for complex and massive structures with high precision without any joints. Another advantage is the possibility to produce shapes and features that are impossible to achieve by subtractive manufacturing technologies.

The technology used in this case is powder bed fusion laser, which is suitable for manufacturing of very complex shapes and utilizes a high-powered laser to fuse small particles of metal powder into a three-dimensional object. The powder is a titanium alloy with a powder size of 10–45 microns, which is applied in layers typically 20–60 microns thick.

With more than 150 years in the metal industry, Sandvik Group has leading expertise across the entire additive manufacturing value chain – offering both advisory and manufacturing services, as well as metal powder. The Additive Manufacturing division has in-house powder manufacturing capabilities of the widest range of AM-alloys – and can even customize materials to demanding applications.

*Find out more*

The mill was topologically optimized, removing as much material as possible, and the material was also changed from tool steel into titanium, which has the advantage to combine low weight with strength.

The design principle for the cutter body was straightforward: the loads caused by the cutting action were analyzed and the cutter design was simply optimized for the highest possible strength.



CoroMill® 390 milling cutter

⚡ A conventional CoroMill 390 shoulder milling cutter in 50 mm diameter and with three size 11 inserts served as a starting point. Additive manufacturing enabled an 80% reduction in weight. The metal

removal capacity increased by up to 200% in face milling at large radial cutter engagements. The test material was SS 2541-03 medium-carbon, low-alloy steel with a hardness of 290HB (EN 34CrNiMo6 / AISI 4340; MC code P2.5.Z.HT). Also, the length of the cutter body was reduced to decrease the distance between the vibration damper mechanism and the cutting edges.

The best performance and smoothest cutting action is achieved by combining the new cutter with Silent Tools™ damping technology. This internal damping system, consisting of a heavy mass supported by rubber spring elements, creates a counter action to induced vibrations and dramatically reduces them.

Sandvik Coromant is constantly looking for the best available technology to optimize the performance for metal cutting applications. Additive manufacturing offers completely new and exciting opportunities to improve tool design and performance in specific conditions and applications.

*Previously Featured in Sandvik's Metalworking World digital publication.*

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