



Press Release

Sandvik created a smash-proof, 3D printed guitar, then challenged rock legend Yngwie Malmsteen to smash it

Rock stars have been smashing guitars for decades, few with more enthusiasm than Swedish-born guitar virtuoso Yngwie Malmsteen. Global engineering company Sandvik decided to test their cutting-edge techniques by building the world's first all-metal, unbreakable guitar and letting Malmsteen unleash his smashing skills on it.

In the film, Malmsteen plays the guitar in front of an excited crowd in a rock club outside Miami – after which he does his very best to destroy it.

Click here to see the film: <https://youtu.be/k1hxZyD9VGI>

Watch how the world's first smash-proof guitar was made: <https://youtu.be/4TKXvyYxoVw>

Sandvik, a world-leader in material innovation and manufacturing, engineered the smash-proof guitar to demonstrate how advanced, precise and sustainable the company's techniques are.

"We don't make products for consumers, so people don't realize how far in the forefront our methods are," says Klas Forsström, President of Sandvik Machining Solutions. "Creating a smash-proof guitar for a demanding musician like Malmsteen highlights the capabilities we bring to all complex manufacturing challenges."

Malmsteen, named one of the ten greatest electric guitar players in the world by TIME Magazine, is known for his virtuoso performances - as well as the fury he unleashes on his guitars. A master of neo-classical heavy metal, Malmsteen has produced 30 albums and has been smashing guitars onstage for over 30 years.

"This guitar is a beast! Sandvik is obviously on top of their game. They put the work in, they do their hours, I can relate to that," Malmsteen said. "The result is amazing. I gave everything I had, but it was impossible to smash."

Sandvik engineers teamed with renowned guitar designer Andy Holt, of Drewman Guitars, to match Malmsteen's exacting musical standards and his lightning-fast playing style.

"We've had to innovate from the top down. There's not a single part of this guitar that has been made before. It's a piece of art, really," Holt said.

The weak point in any guitar is where the neck joins the body. Sandvik solved the problem by milling the neck and the main hub of the body as one piece.

"You could use the guitar as a hammer and it wouldn't break," Holt said.

Several different divisions of Sandvik collaborated to make the instrument. For the guitar's 3D printed body, Sandvik relied on its world-leading expertise in metal powder and additive manufacturing. Lasers traced a design in beds of fine titanium powder, fusing layers of material one on top of the other. The layers, each thinner than a human hair, built up to make the body of the guitar.

"Additive manufacturing allows us to build highly complex designs in small production runs," said Amelie Norrby, additive manufacturing engineer at Sandvik. "It lets us create lighter, stronger and more flexible components with internal structures that would be impossible to mill traditionally. And it is more sustainable because you only use the material you need for the component, minimizing waste."

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The guitar's neck and fretboard were machined by Sandvik Coromant in one machine from a solid block of recycled stainless steel.

"Precision was critical," said Henrik Loikkanen, machining process developer at Sandvik Coromant. "Our software is built on years of experience, giving tool and the cutting data recommendations that helped us mill the fretboard down to a challenging thickness of one millimeter in places."

The next challenge was to strengthen the fret and neck as they extended into the guitar's body. That solution took the form of a new, super-light lattice structure that was sandwiched between the guitar's neck and fretboard. Made from hyper-duplex steel, a recent Sandvik innovation, the lattice structure is the strongest in the world for a given weight.

"Collaborating like this, working together to solve even more complex problems is key for the future," said Tomas Forsman, product development specialist at Sandvik. "Our customers' challenges continue to grow more and more complex. We need to bring our expertise to work hand-in-hand with our partners and customers to invent new ways of meeting those challenges."

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Sandvik AB

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Movies and press images: <https://www.home.sandvik/en/news-and-media/press-material/lets-create/>

Facts about the guitar:

- The guitar body was produced by additive manufacturing, or 3D printing, a technique involving laser-melting titanium powder in microscopically thin layers.
- The guitar's volume knobs and tailpiece which anchors the strings, were also created with 3D printing.
- Additive manufacturing minimizes waste and cuts transport and warehousing because components can be printed in small series close to where they are needed.
- The guitar neck and hub were made of recycled stainless steel and milled all in one machine in one continuous process.
- Extra material was milled from between frets to meet Malmsteen's preference for a scalloped fretboard.
- The back of the guitar's neck is hollowed out from the inside and is only 1mm thick in places.
- Advanced software allowed Sandvik Coromant to simulate milling digitally before the first cut was made, enabling the correct choice of tools, saving manufacturing time and ensuring desirable outcomes.
- Made of hyper-duplex steel, the lattice structure used inside the guitar neck is the strongest structure in the world.
- Only Sandvik makes hyper-duplex steel, combining high yield strength and extreme corrosion resistance unheard of before.
- Before the guitar was built, Sandvik simulated potential impact forces in the same way as car makers digitally crash-test new models.

Sandvik Group

Sandvik is a high-tech and global engineering group offering products and services that enhance customer productivity, profitability and safety. We hold world-leading positions in selected areas – tools and tooling systems for metal cutting; equipment and tools, service and technical solutions for the mining industry and rock excavation within the construction industry; products in advanced stainless steels and special alloys as well as products for industrial heating. In 2018, the Group had approximately 42,000 employees and revenues of about 100 billion SEK in more than 160 countries within continuing operations.