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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. Sandvik decided to test its 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.

<https://www.youtube.com/watch?v=k1hxZyD9VGI>

Sandvik, a world leader in material innovation and manufacturing, created the smash-proof guitar by gathering together its engineers to collaborate and use sustainable, cutting-edge techniques to make something both highly precise and extremely durable.

Göran Björkman, president for Sandvik Materials Technology, said: "Our unique materials knowledge provides exactly what was required to create something as complex and durable as an unbreakable guitar for a master musician. This project was a perfect match for our skills and capabilities and Yngwie's."

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

Malmsteen, named as 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, he has produced 30 albums and has been smashing guitars onstage for more than 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," said Malmsteen. "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," said Holt.

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," added Holt.

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."

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 which 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."

Watch how the world's first smash-proof guitar was made.

<https://www.youtube.com/watch?v=4TKXvyYxoVw>

Notes :

- 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.

About Sandvik

Sandvik is a world-leading developer and manufacturer of products in advanced stainless steels and special alloys for the most demanding environments, as well as products and systems for industrial heating applications.

For more information on Sandvik, visit materials.sandvik

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