PRESS RELEASE

Patent-worthy achievement: VibroDraw enables material-friendly ultrasonic deep drawing in series

You can find them in many household appliances, building technology, and countless pipe and hydraulic lines: small, cylindrical parts manufactured through deep drawing processes. The material is under strain during shaping: Potential consequences are unwanted thinning, surface damage, or cracks. The solution is ultrasonic vibrations - these reduce friction significantly within the material and in contact with the tools. In the VibroDraw process, Fraunhofer IWU, in collaboration with MARK Metallwarenfabrik GmbH and DEVAD GmbH, has successfully integrated ultrasonic vibrations into industrially relevant deep drawing processes with cycle rates of up to 500 strokes per minute.

Ultrasound can reduce friction in deep drawing and thus protect tools and materials. The energy-saving potential resulting from lower forces is something manufacturers of pipes and fittings (connection materials) would also like to utilize. However, it was only the team led by M.Sc. Martin Mädlow that managed to control the typical sudden stresses in industrial forming processes. Previously, effective use of ultrasound was only possible in nearly static laboratory setups.

At least 20 percent less friction

For vibration excitation, active tool parts such as the punch and die, plus the blank holder that keeps the sheet metal in the desired position during forming, are all viable. The researchers chose the die, as it has the largest share of relative movement during forming. "The die offers the most potential. We've already achieved a 20 percent reduction in friction, but we still see further potential," emphasizes Mädlow.

Regulated by the process force transmitted through the workpiece, forming usually occurs in several stages. Thanks to less friction, it is possible to deep draw much further in a single stage without damaging the material. For example, two forming steps are sufficient instead of three conventional ones. Reduced friction also means less heat input, which allows for higher stroke frequencies, and longer tool lifespans, and prevents the coking of lubricants.

Contact
Andreas Hemmerle | Fraunhofer IWU | Phone +49 371 5397-1372 |
Reichenhainer Straße 88 | 09126 Chemnitz | Germany | www.iwu.fraunhofer.de | andreas.hemmerle@iwu.fraunhofer.de |

Transfer to practice, benefits for electromobility, patent application

Fraunhofer IWU is advancing its activities to transfer this technology to industry swiftly. Currently, the focus is on ultrasonic deep drawing of cell housings used in high-voltage batteries for electric vehicles. The goal is larger cell formats that make better use of space and provide higher ranges thanks to increased energy density. The patent application for VibroDraw (EPA WO2025/012830 A1) has already been filed.

Successful precedent: VibroCut

The successful application of vibration excitation to deep drawing processes follows the example of a spin-off from Fraunhofer IWU: VibroCut, which uses vibrations in machining processes to reduce cutting forces and tool wear. See the press release on VibroCut: Vibration-assisted machining.

The achievements of the project partners in the umbrella project "TS-GEOTEXOUS" were funded by the Austrian Research Promotion Agency (FFG).

Fig. 1: Ultrasonic deep drawing makes the difference: with a drawing ratio of 2.3 and vibration support, the deep-drawn ›bowl‹.

Fig. 2: With identical parameters but without ultrasonic support, the metal cracks.
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Fig. 3: Series-capable: Deep drawing with ultrasonic actuation under the die.
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