

# Laser metal deposition yields tougher automotive dies

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Thanks to laser metal deposition, the optimized forming die from Mühlhoff Umformtechnik GmbH is more robust than the previous. The photo shows the machine system used. Credit: Fraunhofer IPT

Forming dies are put under immense strain. Yet by using a laser to alloy their surfaces with filler material you can make them more robust and resistant to wear. This process increases the service life of dies used in automotive manufacturing by 150 percent.

Slowly the metal punch approaches the piece of sheet metal and pushes it into the press with a force of several tons, producing automotive components in a matter of seconds. Known as deep drawing, this special forming process is used by the automotive industry to form vehicle body parts into the requisite shape. As smooth and delicate as the process looks in the production hall, it actually puts enormous strain on dies. This is because of the high pressure generated during the pressing operation – above all at the die shoulders. These are the areas of forming dies where the material is drawn into the requisite shape, and it is precisely these surfaces that tend to wear very quickly. To function properly, the dies have to be maintained regularly and even replaced in extreme cases. This can see expensive [manufacturing](#) machines standing idle for up to an hour. Moreover, pressing dies are costly, one-of-a-kind items made from special raw materials. Even dies just a few centimeters in size cost up to 600 euros.

What manufacturers need are processes that increase the lifetime of dies and reduce set-up times. One such method is laser metal deposition. A laser beam carefully melts the surface of the die and the [filler material](#) to produce a local layer that guards against wear on the die surface. This process increases the robustness and resilience of the stainless steel die at critical points. The laser beam treatment is completed in fractions of a second. What has been lacking until now, however, is a universal, reproducible process for practical industrial use. This deficiency has now been remedied by researchers from the Fraunhofer Institute for Production Technology IPT in Aachen together with the tool maker Mühlhoff Umformtechnik GmbH and further partners in the course of a project within the Green Carbody Technologies Innovation Alliance (InnoCaT®).

## **Lifetime increased by 150 percent**

Researchers rebuilt a conventional five-axis milling machine so that it

could be used to alloy forming dies automatically via laser. The machine can be embedded into the current manufacturing process and increases the lifetime of dies by over 150 percent. The new process also improves the quality of components and makes it possible to plan set-up times with greater precision, as practical tests carried out on Mühlhoff's premises have shown. Mühlhoff, which is based in the Uedem municipality of North Rhine-Westphalia in western Germany and which has over 340 employees, manufactures sheet metal components for the [automotive industry](#). The company's own toolshop supplies its various production locations with forming dies.

In addition to the laser metal deposition machine, another key part of the system is the integrated CAx software (CA = computer-aided). This software allows all the requisite laser surface treatment processes to be controlled in a clear, reproducible manner. All necessary process parameters are transmitted to the machine without the need for any interface. Processes can be simulated in detail and optimized in advance of actual processing operations.

In 2010, over 60 partners from industry and research joined together in InnoCaT® with the aim of carrying out joint research into innovations and synergies along the automotive process chain. For the first time, they analyzed the complex production flows in their entirety and from a resource efficiency perspective, taking in each stage from tool-making to pres- sing, car body construction, and painting car body shells. Five collaborative projects and 30 sub-projects yielded technical solutions and general approaches for increasing energy and resource efficiency before the initiative came to an end this summer.

Provided by Fraunhofer-Gesellschaft

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