
Press release

Scientists from Hannover develop a novel lightweight production process

Hybrid compound forging combines steel sheets and bulk aluminium parts in one component

In cooperation with the Institute of Welding and Machining (ISAF) of TU Clausthal, the Institut für Integrierte Produktion Hannover (IPH) gGmbH is developing a novel forging process for lightweight car manufacturing. The researchers' aim is to create a material bond between steel sheets and bulk aluminium parts already during the forming process – without the need for an extra joining step. This would contribute to a faster and more efficient production of load-optimized components.

Hybrid compound forging is the first process that combines two lightweight construction approaches, namely creating a material bond between steel sheets and bulk parts, and employing different materials with different properties – such as lightweight aluminium and strong steel.

The researchers' idea is to form and join a steel sheet and a solid aluminium stud in one process step. In the past, the individual parts have been formed first and then joined in a second step, for example using stud welding. The idea of hybrid compound forging is to eliminate the subsequent joining step – and facilitate a faster and more efficient production of lightweight components.

When designing the novel lightweight production process, IPH and ISAF have to meet two challenges: Since aluminium has a considerably lower melting point than steel, the joint forming process is more complicated. Moreover, the mixing of steel and aluminium creates brittle intermetallic phases, a material bond which is not strong enough and thus unsuitable for car manufacture. For this reason, the researchers employ zinc-plated steel sheets and aluminium studs: Zinc firmly bonds to aluminium as well as to steel without creating brittle phases.

Within the scope of the research project “Hybrid Compound Forging”, the researchers' task is to determine the most suitable process conditions – i.e. optimal temperature, pressure and speed for successfully forming and joining the two parts. They also try to identify the suitability of the novel process with respect to different types of sheet thicknesses and stud shapes. Another topic is to determine the joining zone's capacity to withstand load as well as the machinability of the hybrid part after joining.

In future, hybrid compound forging could be used in the automotive and aerospace industry to produce components, such as longitudinal beams, tail lamp mounts or cargo tie-down rings. Lightweight construction plays an important role in the automotive and aerospace sector: Lesser weight means lower fuel consumption. Over the years, the Institut für Integrierte Produktion Hannover (IPH) gGmbH has already been dealing with various lightweight approaches in sheet and bulk metal forming, like for example cross wedge rolling and hydroforming of hybrid steel and aluminium parts. The researchers have already succeeded in combining sheet and bulk metal parts of different materials in one single forming step – but only as a prototypic form-fit connection between steel sheet and aluminium stud. In the current research project “Hybrid Compound Forging”, the researchers are going for a material bond using zinc as filler material which also offers advantages as to contact corrosion in the steel-aluminium material combination.

The project is funded by the German Research Foundation (DFG). For further information please refer to www.verbundhybridschmieden.iph-hannover.de.

About the IPH

The Institut für Integrierte Produktion Hannover (IPH) gemeinnützige GmbH (which literally translates into Hannover institute of integrated production) is a service provider for production technology and was established in 1988 at the Leibniz University in Hannover. The IPH offers research and development, consultation and qualification concerning the subjects of process technology, production automation, logistics and XXL products. Its customers include companies from the sectors of tool and mould construction, machine and plant construction, aerospace and the automotive industry, electro industry and forging industry.

The business has its headquarters in the science park Marienwerder in the northwest of Hannover and currently employs 64 people, of which 28 are scientific personnel. (Status: August 2017).

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Photo material



Hybrid compound forging: The novel lightweight production process firmly bonds bulk aluminium parts to steel sheets – already during the forming process without an extra joining step. (Photo: IPH)



Aluminium stud meets steel sheet: IPH researchers have already succeeded in creating a form-fit connection. Now they want to realize a material bond between the two parts. (Photo: IPH)