

## "Unlikely couples" of materials enable vehicle weight to be reduced

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CICmarGUNE, the Co-operative Research Centre into High-performance Manufacturing, is working to develop hybrid aluminium-steel and composite metal joints by means of different technologies that enable components with greater added value to be manufactured, thus contributing towards improving the competitive position of Basque companies. The Faculty of Engineering of Mondragon University, IK4-Lortek, IK4-Azterlan, IK4-Tekniker and Tecnalia are collaborating in this line of research within the framework of CIC marGUNE's

"InProRet" (Eortek ) strategic research project.

Environmental problems are driving forward the appearance of increasingly restrictive regulations, so the strategy of vehicle manufacturers is geared towards cutting vehicle weight. CIC marGUNE, the Co-operative Research Centre into High-performance Manufacturing, is working on the line that involves joining [hybrid materials](#) in order to develop technologies that will allow components with greater added value to be obtained by joining dissimilar [materials](#). "The demand for hybrid joints or the joining of different materials is continually growing due to the fact that for certain applications and features the existing materials on their own do not allow the requirements to be met," said Erik Echaniz, a CIC marGUNE researcher and member of the Advanced Material Forming Processes research group at the Mondragon University's Faculty of Engineering.

The development of new, more effective, longer-lasting and lower-cost joining processes is essential to achieve this aim to use more light materials extensively in all kinds of vehicles. Within this framework, "the design and manufacture of hybrid structures offers great potential on a technical as well as economic level for companies in the automotive sector," he added. In Europe, for example, the automotive industry is intensifying the use of aluminium and other light materials (composites, magnesium, etc.) in vehicle framework and chassis, their use having almost doubled between 2000 and 2010; the use of them is expected to account for nearly 70% of these components by 2020.

## **Joining materials together**

Traditionally, iron and aluminium alloys are some of the most important materials in the automotive and aeronautical industry due to their good properties. The joining of the two materials allows new hybrid structures to be created; these structures combine the toughness and wear resistance

of low density aluminium alloy steels. However, the joining of dissimilar materials is complicated owing to their different natures. In the specific case of traditional aluminium-steel welds, aluminium-rich intermetallic compounds are formed, and due to their hard, brittle nature they lead to harm in their final application. On the other hand, joining technologies of this type have significant limitations in terms of the geometry of the blended structure.

Research is being conducted into the following technologies: co-casting, friction, laser, advanced arc welding, joining by means of adhesives and thixoforming (joining through superforming in a semi-solid state). In this area, attention should be drawn to thixoforming, which is a promising technology for manufacturing in a single step "near net shape" functional components with good mechanical properties.

"Thixoforming technology means we have been able to produce an acceptable joining of parts with a certain geometrical complexity and, as a result, we have managed to considerably reduce the weight of an actual part by about 40%," stressed Echaniz. What is more, "the process is robust and repetitive; there is no great dispersion between some parts and others, and the parts have no defects", he added.

"Mastering these technologies is becoming increasingly important and strategic for the automotive sector in the Basque Country," concluded Echaniz.

Provided by Elhuyar Fundazioa

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