

JOIN'EM project addresses the increasing requirements of industrial enterprises to weld dissimilar materials

New EU project to facilitate aluminium-copper joining by electromagnetic fields resulting in increased performance, efficiency and environmental benefits to Europe's industry

Lisbon, 16th October 2015 – The manufacturing sector is faced with new challenges to remain ahead of the competition and abreast of regulatory requirements. This comes with the need to seek innovative approaches including the development of new materials and the ability to use different materials together in one component or structure. These challenges are part of a trend to manufacture lighter, safer, more environmentally-friendly, high-performance and cheaper products. Scientific research as well as successful industrial case studies has shown that the performance requirements of innovative products can only be met if the material properties are ideally adapted to the requirements, the load profile, and the function of each individual component.

The JOIN'EM project addresses current shortcomings of more traditional welding technologies when **joining dissimilar metal combinations** and it aims to create a cost-effective and practical way of joining aluminium and copper. Joining by electromagnetic forming (EMF), also called electromagnetic pulse welding, is a promising innovative technology which can be used for welding of similar and dissimilar material combinations, including multiple combinations, which are difficult or impossible to join using conventional processes. The joint is formed without heat, but due to the impact of the joining parts. This process needs no fluxes or shielding gases and produces no harmful smoke, fumes or slag, thus reducing the overall negative impact on environment while improving working conditions for factory staff.

The implementation of electromagnetic pulse welding will allow designers to combine metals or to integrate new metals. This, in turn, will allow a steep increase in production performance and will pave the way for several new application areas in the fields of electric devices, heating and cooling, automotive and transport, white goods, air-conditioning, and more recent fields such as high power electronics and energy storage, enabling these industries to follow new trends in product design and manufacture components and products at a top level.

The new joining solutions will also help to implement improved lightweight designs with further weight reduction and better performance. This will decrease energy consumption and greenhouse gas emissions, an increasingly significant requirement for industries such as car manufacturing, where a weight reduction of 100 kg can result in fuel savings of about 300 to 800 litres over the vehicle lifetime, as well as reducing CO₂ emissions by 9 grams per kilometre.

The JOIN'EM project will optimise usage of a finite resource – copper – for industry's benefits

Due to its excellent thermal and electrical properties, copper is the third most frequently used raw material in the world. JOIN'EM directly aims at decreasing the consumption of this high-cost material by partially substituting it with aluminium. At the current level of known reserves and expected consumption, it is expected that copper will become ever more expensive and difficult to obtain, creating an additional cost issue for manufacturers. So, even if the replacement of copper with aluminium can only happen partially, it will have a lasting impact on the targeted industries.

JOIN'EM will:

- Develop innovative methods for joining dissimilar metals, which will allow improved manufacturing of new products. These innovations will also deliver increased product reliability, longer lifetime of the components and welds, combined with a reduction of maintenance costs;
- Facilitate an increased use of dissimilar metal combinations;
- Increase productivity and reduce costs for realising hybrid components using electromagnetic pulse welding: joining operations are performed faster, more efficiently and robustly, with a less expensive production process and better-quality final products;
- Achieve lower product life cycle costs;
- Enable the use of the environmentally-friendly electromagnetic pulse welding process. This process needs no fluxes or shielding gases and produces no harmful smoke, fumes or slag, thus reducing the overall environmental impact.
- Investigate joint performance with conventional as well as novel testing methods.

Looking ahead: The future of electromagnetic welding

Beyond this application, project partners will also look into the transferability of project results to other material combinations of relevance for industrial sectors that deal with multi-material joints. JOIN'EM will develop and demonstrate flexible and cost-effective joining processes for dissimilar metal combinations, for which currently available conventional welding technologies have proved inadequate.

Project partners include Fraunhofer - Gesellschaft für angewandte Forschung e.V. (FRAUNHOFER); Belgian Welding Institute (BWI); PFT Innovaltech (INNOVALTECH); Armines/Mines Douai (ARMINES); Research Center for Non Destructive Testing GmbH (RECENDT); Phimeca Engineering S.A. (PHIMECA); Vertech Group SARL (VERTECH); European Federation for Welding, Joining and Cutting (EFW); Whirlpool Europe SRL (WHIRLPOOL); Calyos SA (CALYOS); Cegasa Portable Energy (CEGASA) Alke SRL (ALKE), Refco nv (REFCO); Institut Catholique d'Arts et Métiers (ICAM).