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Institut de Soudure Group and Arkema win 2020 JEC Composites Innovation Award for Aeronautics with their Innovative Solutions for Welding (ISW) of thermoplastic composites parts

Institut de Soudure Group and Arkema, in partnership with Hexcel, Latecoere and Stelia Aerospace (France) have jointly won the 2020 JEC Composites Innovation Award for Aeronautics with their Innovative Solutions of Welding (ISW) of thermoplastic composites parts.

This solution has been co-developed by Institut de Soudure Group and Arkema respectively providing expertise in welding technology and high performance polymers.

The use of thermoplastic composites in aeronautics is a big challenge for the coming years and requires a welding technology showing good mechanical performance with cost effectiveness.

The innovation consists in the design and the set-up of a very high performance process that allows welding of any thermoplastic matrix reinforced with fiber. The ISW is mainly dedicated to high quality joining of high performance thermoplastic (PEKK) reinforced with carbon fiber but can be applied to any other matrix (from PA to PAEK) and fiber (glass, aramid...).

ISW allows welding joint coefficients of about 85% compared to raw material, without any foreign object at the welding line after operation.

ISW solution is based on the use of a susceptor that is linked to and moves with the induction coil in the welding head as well as an interface ply of unreinforced or low-fiber-volume pure thermoplastic matrix, which can be tailored per application.

The welding head generates cooling under pressure of the substrates to ensure compaction of the welding line. "We sense temperature with a laser pyrometer which actually measures the edge of the susceptor from the side. So, we know exactly the temperature at the interface. We also have a cooling device blowing air on the welding surface in pressure to be sure we are below the crystallisation temperature, so there is no risk of de-compaction once pressure is released", explains Jérôme Raynal, Aeronautics & Composite director.

This innovative head with mobile susceptor is very compact to allow precise and complex access. ISW is designed to be fully automated with the welding head attached to a 6-axis robotic arm.

Key Benefits

- High performance welding (joint coefficient of 85% min)
- Reduction of post operation (no adhesives or tapes and chemical products)
- Reduction of weight
- No susceptor remaining at welding joint
- Dynamic and fully automated/monitored solution
- Ecological impact : use of recyclable material and low energy consumption due to a very localized heating
- Can be used with any thermoplastic matrix and any fiber.



Several developments for aeronautical structural parts

Institut de Soudure Group has been developing composite welding technologies for more than 10 years in several technologies as resistive welding, co-consolidation and induction welding.

For the ARCHES BOX TP demonstration project with Stelia Aerospace, which was unveiled at the 2017 Paris Air Show, the Group has been in charge of the welding of stringers on skin using dynamic induction welding process. This project was the start of the development with induction welding for aeronautical structural parts.

Based on this development, Institut de Soudure Group and the thermoplastic materials supplier Arkema have developed this new technology which aim is to improve weak points of the conventional induction:

From the beginning of 2019, some feasibility studies have been initiated with main aeronautic players such as Stelia Aerospace and Latecoere in order to evaluate the solution developed. From 2020, the main objectives are to increase maturity of the technology and to get involved in specific aeronautics projects in order to lead it to qualification.

Profile of Institut de Soudure Group

The Institut de Soudure Group has 27 centres in France and 7 abroad; it employs over 1,000 people and lends its expertise to the world of industry. Through its R&D platforms and its expertise, which has been renowned for over 100 years, the training it provides in its training centres and its two schools – ESSA and EAPS –, the Group caters to the welding branch and related controls. It provides innovative solutions to companies all over the world, during design, manufacture or maintenance of welded equipment and multi-materials assemblies, either metallic or composite. To ensure risk control in the world of industry and to guarantee product quality, it offers inspection and testing services as well as metallurgic expertise. Regarding Composites and Aeronautics activities, Institut de Soudure Group is active in: Thermoplastic composites welding; Direct processes; Non Destructive Testing; Destructive Testing.

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