Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Friction Riveting

Multi-material Joining Technology

Patent status:
EP 1790462 (DE, ES, FR, GB, IT, PT, SE) granted
US 7575149 granted
CA 2568178 granted

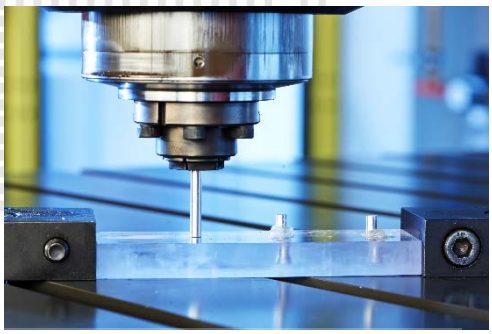

Image: HZG/WMP

Challenges

The ever growing requirement for lightweight construction makes it necessary to join a wide range of different materials. Especially thermoplastics and engineering plastics offer a tremendous potential for lightweight application. The lack of current welding technologies to join these materials, e.g. polycarbonate (PC) with polypropylene (PP) or time-consuming adhesive bonding technologies motivates our research.

Technology

The Friction Riveting (FricRiveting) joining technology has been developed as a solution to perform similar and dissimilar polymer and hybrid metal-polymer or polymeric composite overlapping joints. This joining technology is based on mechanical anchoring and interference. The bond is achieved by plastic deformation of the rivet and adhesion between the metallic and remnant joining partner. The rivet is turned into the material from one side only, which makes it ideal for hollow section joints. The overall benefits are the smaller diameter design of the joining rivet, which leads to a decrease in tension in the structure and as an additional plus FricRiveting takes a maximum of only 10 seconds (depending on the parts to be joined) per joint to execute, which outperforms conventional riveting by far.

Areas of Application

FricRiveting can be of interest to various industrial sectors where polymer-metal and composite-metal hybrid structures are in use, in development or required. The use of this technology would contribute to possible weight, time and cost savings. This process offers the possibility to reduce joining cycles and operational steps in comparison to conventional joining techniques.

Development Status

The process has been demonstrated using several material combinations, including steel, aluminum and titanium alloys as metals, with both unreinforced and glass/carbon-fiber-reinforced thermoplastics and thermoset composites. Quasi-static strength and cyclic mechanical behavior have been assessed. Weathering tests have also been carried out.

Exploitation Opportunity

Helmholtz-Zentrum Geesthacht offers the described technology for in-licensing and/or for the further development and exploitation. Within the scope of a cooperation, interested companies can be supported in adapting this technology to their specific requirements.

Publication

- N. Z. Borba, C.R.M. Afonso, L. Blaga, J.F. dos Santos, L.B. Canto, S.T. Amancio-Filho, Materials 2017, 10 (2), 184-204.
- G. P. Cipriano, L. Blaga, J. F. dos Santos, P. Vilaça, S. T. Amancio-Filho, Materials 11(12) 2018
- N. Z. Borba, L. Blaga, J. F. dos Santos, S. T. Amancio-Filho, Materials Letters 215 (2018), pp. 31-34

Advantages:

- Short joining cycles
- No pre-joining operations
- Wide range of dissimilar material combinations
- Several joint configurations possible

Application:

- Riveted aircraft fuselage
- Structural riveted clips
- Riveted girder connections
- Secondary structural automotive applications

Industrial Sector:

- Aerospace
- Automotive
- Civil Engineering (e.g. bridges)
- Shipbuilding
- Etc.

Awards:

- SPE-ANTEC, USA 2016
- Automotive Engineering EXPO (AEE) 2015's Rising Star
- Lightweight Design from Germany Trade & Invest (GTAI), 2015
- Raiser Reibschweissen Innovationspreis 2014
- Henry Granjon Prize 2009 of the International Institute of welding
- u.a.

Helmholtz-Zentrum Geesthacht
Max-Planck-Straße 1
21502 Geesthacht

Contact:
Nicole Kleimeier
Tel +49 (0)4152 87-1678
nicole.kleimeier@hzg.de