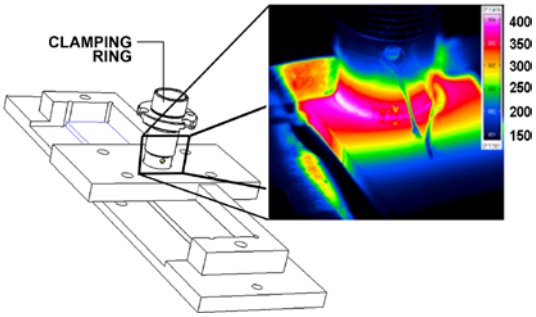
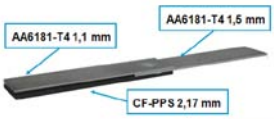
Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

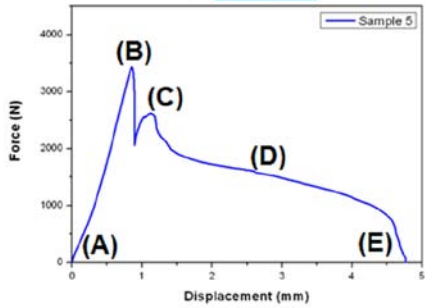
Friction Spot Joining of 6XXX Series Aluminum Alloy and Carbon Fiber Reinforced Thermoplastic for Transportation Structures

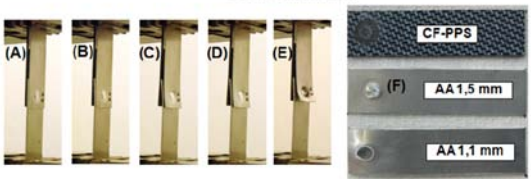
João V. Esteves (UFSCar, Brazil), Sergio Amancio (Contact Person)

Challenge









Facing the rigid environmental requirements to reduce the greenhouse gas emissions, the transportation industry currently seeks alternative clean production technologies to meet the rigid legal and market demand for vehicles that consume less fossil fuel. The combined use of lightweight alloys and polymer composites to replace heavy structures is currently a major subject in the automotive and aircraft industries. Carbon fiber reinforced polymers are being widely used in combination with aluminum, due to positive gain in specific strength (e.g. strength-to-weight ratio). For instance, the next-generation A350 XWB, produced by Airbus, is composed of more than 50 percent composites which saves weight and reduces maintenance by decreasing corrosion and fatigue, leading to lower operating costs. The available techniques to join composite-metal multi-material structures are either too expensive, limited in performance or are not environmental friendly. Consequently, there is a niche to be explored in the development of new joining technologies.

Objective

The goal of this work is to investigate the feasibility of the friction spot joining technique in producing single and double lap joint connections on aluminum AA6181-T4 and carbon fiber reinforced poly(phenylene sulfide) laminates. These materials are currently used by the European aircraft industry to produce primary and secondary structures. These structures are currently riveted and bonded presenting expensive and complex joining procedures. The process and the joint characteristics are analyzed in terms of process temperature, microstructure and mechanical performance under static loading.