An experimental and numerical study of the performance characteristics of novel hybrid metal-composite joints

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Reducing structural weight is a key way of reducing fuel consumption for transport systems. In addition, emerging electric vehicle platforms demand lightweight structures to compensate for the heavy batteries and electric drivetrain. Light-weighting of automotive structures requires the use of multi-material designs that integrate materials such as aluminium, high strength-steel, fibre reinforced composites and plastics. However, the biggest challenge presented by these designs is the joining of dissimilar materials, while meeting the ever-increasing safety and performance standards. Hybrid joining [1-4], which combines the advantages from conventional methods like mechanical fastening and adhesive bonding, is an evolving research area to devise a cost-effective joining solution for multi-material assemblies.

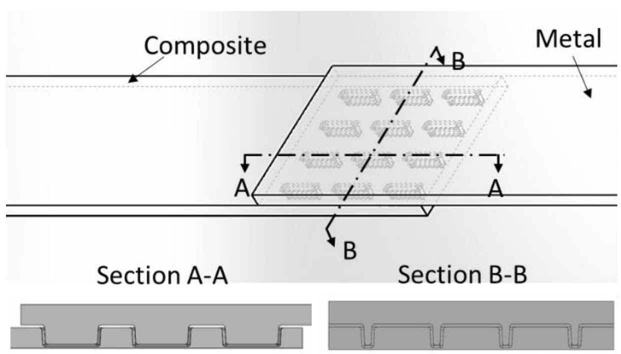

Figure 1. Interlocking adhesive joint design

A novel joining technique for metal-composite joints is investigated in this project. The effect of employing interlocking features, on the faying surfaces of the "female" carbon fibre/polyamide-12 thermoplastic composite and the "male" aluminium alloy, AA5574-H111 adherends (Figure 1) is studied. The results of performance enhancements obtained through this novel joining technique are compared to data from "baseline" adhesively bonded single-lap joints. Suitable models for simulating the interlocking adhesive bonded joint in the finite element framework will be identified for further study and optimisation of the joint configuration.

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