Functionally graded bond-lines for metal/composite joints

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ABSTRACT

Failure in adhesive joints is usually the result of the non-uniform distribution of stresses that generally appears along the bond-lines, with peak values near the ends of the overlaps and inner zones where the adhesive essentially does not work. For joints comprised of dissimilar materials, the stress fields are also affected by the absence of symmetry.

The present work refers to the utilization of 'functionally graded adhesive joints' to avoid the mentioned phenomenon and improve the maximum load capacity of aluminium/composite joints under shear loads. In this sense, it is clearly shown how a combination of a more flexible/ductile adhesive in the overlap extremes with a gradual transition to a stiffer one in the central zone gives a better response in the final shear behaviour.

In order to optimize the 'graded' solutions, a finite element study has been performed considering different variations of properties in the bond-lines. In the study, the FE models have been used within a parametric exploration process searching the maximum ultimate loads. Finally, some of the resultant distributions have been tested, and the experimental results have been compared with the corresponding numerical ones.