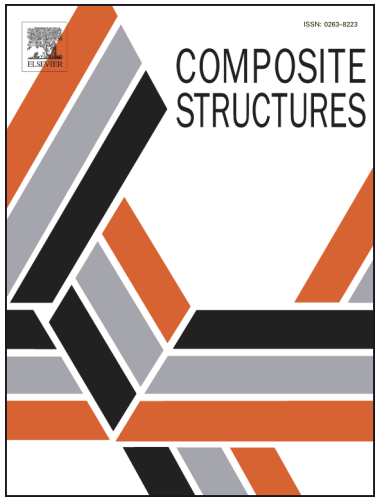

Modelling and testing of fibre metal laminates and their constituent materials in fire

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MODELLING AND TESTING OF FIBRE METAL LAMINATES AND THEIR CONSTITUENT MATERIALS IN FIRE

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ABSTRACT

A modelling and experimental study is presented into the deterioration to the load-bearing performance of fibre metal laminates (FML) when exposed to fire, and compared to the constituent materials (monolithic metal and composite). A thermal-mechanical model is presented to calculate the temperature, softening and failure stress of load-bearing FMLs in fire. Experimental fire-under-load tests are performed on an FML consisting of thin bonded sheets of aluminium (AA2024) and glass fibre-polymer (GRP) composite, and its load-bearing performance in fire is compared to its consistent materials (monolithic aluminium and GRP composite) of the same thickness. The softening rate of the FML is generally faster than the monolithic aluminium or GRP plates, and its load-bearing capacity is inferior or similar to its constituent materials depending on the applied stress and radiant heat flux of the fire. The load-bearing performance of the FLM is reduced by softening of both the metal and GRP layers as well as interfacial debonding between the layers. The model is capable of calcualting with reasonable accuracy the reductions of the tensile and buckling failure stresses of the load-bearing FML in fire.

Keywords: Fibre metal laminates; Fire; Analytical modelling; Mechanical properties

1 INTRODUCTION