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MULTI-LAYER POLYMER METAL LAMINATES FOR THE FIRE PROTECTION OF LIGHTWEIGHT STRUCTURES

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ABSTRACT

A multi-layer polymer metal laminate (PML) system is described, which can be used to thermally insulate lightweight structural materials, such as aluminium or carbon fibre reinforced plastic (CFRP) composite, when exposed to fire. The system comprises many thin adhesively-bonded metal foils, bonded directly to the structural substrate. When exposed to fire the PML adhesive thermally decomposes with the generation of volatiles, causing the foils to delaminate and inflate, thus greatly reducing its thermal conductivity. The expanded PML slows heat transfer from the fire into the structural substrate, resulting in lower temperatures and increased structural survivability. The fire protection effects of two different thicknesses of PML are demonstrated here for both aluminium and CFRP substrates. Fire exposure tests demonstrate that the substrate temperatures are reduced and the time to failure under load is substantially improved. The protection offered is equivalent or superior to conventional fire protection materials such as ceramic fibre mat or intumescent coatings. The advantage of the PML is that, in non-fire conditions, it contributes to the appearance and load-bearing capability of the structure without being prone to damage or water absorption.

KEYWORDS: fire protection, multi-layer laminate, composites, CFRP, aluminium, structural survivability