Fire penetration in an aircraft made in composites, results of preliminary researches using a scale demonstrator.

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ABSTRACT

The improvement in the composite material behaviour against fire is one of the challenges the aeronautical industry must face up to spread their use in the primary structural elements as fuselage and wings. All international authorities are worried about the safety of these materials against toxicity, flammability and structural strength in a fire event.

Fire event is one of the main reasons of aircraft fatal casualties. In a majority of survivable accidents where there is a fire, ignition of the interior of the aircraft is caused by burning jet fuel external to the aircraft. Fire penetration time, heat emission, smoke density and toxicity of the gases generated during fuselage combustion are critical factors for passenger survivability.

This paper will present the preliminary results of the fire behaviour of the new and recent thermoset composite materials applied in the aeronautical industry.

Two different test campaigns have been conducted. A preliminary study has been carried out for characterization of the different composite materials. They have been tested according to aeronautical usual test requirements to obtain flammability, flame propagation, heat emission, smoke density and toxicity data.

Finally, composite curved coupons have been produced to be tested in a scaled (1:4) demonstrator of an airbus A320 fuselage, simulating real fire conditions. The demonstrator is a metal fuselage section with a hole in which the curved coupons are placed. They are exposed to a large jet fuel fire to simulate the penetration of an external post crash fire. A comparison between traditional metallic allow fuselage and the new composite materials has been performed. Fire penetration time, heat emission, temperatures inside the cabin and toxicity of the gases have been measured during the tests and considered for this study. Correlation between the results obtained in the scale demonstrator and the real scale are showed.

Future research must follow to improve the structure fire strength using advanced thermoplastic composites and nanomaterials, also to know the fire behaviour against applied loads to evaluate the residual strength of a burnt structure, to develop numerical models for fire simulation, and to build a full composite fuselage barrel demonstrator test to understand globally all process.