Composite materials for aircraft application

Psychology, Child Development

Introduction

Composites are versatile, used for both structural applications and components, in all aircraft and spacecraft, from hot air balloon gondolas and gliders to passenger airliners, fighter planes, and the Space Shuttle. Composites materials is the most important consideration in aircraft structure, and other properties such as the cost, ease of manufacture or mechanical performance could be of lesser importance. For example, resistance against cracking and spalling owing to rapid heating, known as thermal shock resistance, is an essential property for materials used in the exhaust casing of rocket engines. The focus of this report is to investigate/explain the use of composite materials in aircraft.

Findings

There are several reasons why aircraft manufacturing uses composite materials. Researchers explain that have allowed engineers to overcome obstacles that been me when using the materials individually. The constituent materials retain their identities in the composites and do not otherwise merge completely into each other. Together, the materials create a ‘ hybrid’ material that has improved structural properties. Thermal conductivity is a consideration for materials used in high-temperature applications such as heat shields and engine components. Heat-shield materials require low thermal conductivity to protect the airframe structure from excessive heating.

Thermal expansion is also a consideration for high-temperature materials. Materials with a low thermal expansion coefficient are often required to

avoid excessive expansion and contraction during heating and cooling. Flammability is a consideration for materials where there is the risk of fire, such as aircraft cabins and jet engines. Flammability properties such as ignition temperature, flame spread rate and smoke may need to be considered. Materials with the capability to absorb radar waves and/or reduce the infrared visibility are important for aircraft.

According to Rusin et al. (2015), experiments have shown that material based on silica or quartz cloths and inorganic binder (phosphate, aluminochromophosphate) have a high strength level, improved impact strength, low linear thermal expansion coefficient, exhibit stable thermophysical properties at high temperature, and retain dielectric properties under elevated temperature conditions. In various branches of industry, particularly in the aircraft industry. During of work within ONPP Technology several different forms of multilayer structures have been developed. The first version of a multilayer structure is a test specimen, whose facing was made from composite material, and a central layer of fiberglass-reinforced plastic type SSP. Heat resistance of the specimens obtained exceeded 1200°C (test method GOST 9. 715). The change in dielectric parameters in the range 20 – 800°C does not exceed 5% with a frequency of ~1010 Hz.

Discussions

Composites are versatile, used for both structural applications and components, in all aircraft and spacecraft, from hot air balloon gondolas and gliders to passenger airliners, fighter planes, and the Space Shuttle.

Applications range from complete airplanes such as the Beech Starship to wing assemblies, helicopter rotor blades, propellers, seats and instrument enclosures. The types have different mechanical properties and are used in different areas of aircraft construction. Carbon fiber, for example, has unique fatigue behaviour and is brittle, as Rolls-Royce discovered in the 1960’s when the innovative RB211 jet engine with carbon fiber compressor blades failed catastrophically due to birdstrikes.

Whereas an aluminium wing has a known metal fatigue lifetime, carbon fiber is much less predictable (but dramatically improving every day), but boron works well (such as in the wing of the Advanced Tactical Fighter). Aramid fibers (‘ Kevlar’ is a well-known proprietary brand owned by DuPont) are widely used in honeycomb sheet form to construct very stiff, very light bulkhead, fuel tanks, and floors. They are also used in leading- and trailing-edge wing components. In an experimental program, Boeing successfully used 1, 500 composite parts to replace 11, 000 metal components in a helicopter. The use of composite-based components in place of metal as part of maintenance cycles is growing rapidly in commercial and leisure aviation.

Overall, carbon fiber is the most widely used composite fiber in aerospace applications.