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Composite materials in aircraft

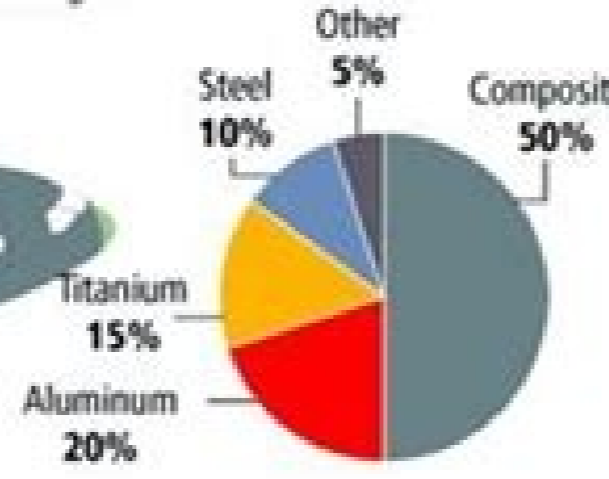
Materials used in 787 body

- Fiberglass
- Aluminum
- Carbon laminate composite
- Carbon sandwich composite
- Aluminum/steel/titanium

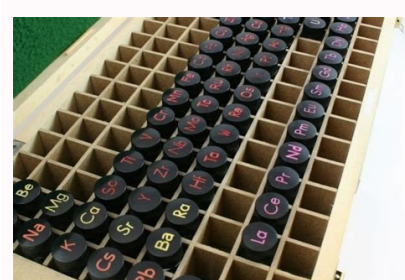


Total materials used

By weight



By comparison, the 777 uses 12 percent composites and 50 percent aluminum.



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Belly fairing consists of about 100 panels of compound honeycombs. They are also used for floor beams, wing fairing and landing gear doors. The A380 has about 20 to 22 percent composit by weight and also makes extensive use of Glare (fiberglass reinforced aluminum alloy), which has on front fairing, top fuselage shells, panel sides and crown, and the upper sections of the front and rear upper fuselage. Spicy epoxy fur constitute about 75% of the outer area. The sidebar on page 15 lists some aircraft in which significant quantities of computed materials are used in the structure. Computed materials are one of these classes of materials that play a significant role in current and future aerospace components. Madeira and bone are natural materials: wood is constituted by cellulose fibers in a lignin matrix and the bone is constituted by particles of hydroxyapatite in a collagenium matrix. Initially, computed materials were used only in secondary structures, but as the knowledge and development of materials has improved, their use in primary structures, such as wings and fuselages, increased. Compounds of CFRP and GFRP particles are fibrous composites; Another category of composites are the particle composites. The formability of the composites has been used with particular advantage in the manufacture of helicopters to reduce the number of components and therefore the cost. Disadvantages The few disadvantages of computed materials are the expenses with raw materials in comparison with most metallic alloys, the highest cost of manufacturing of components Composites in many cases and its susceptibility to moisture in some cases. Differences between fibrous and particulate compounds probably the most important difference between fibrous and particulate matter, and indeed between fibrous compounds and conventional metallic materials, is directionality of properties. 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These are presented in over 1340 design guides with supporting software and are the result of more than 60 years experience of providing engineers with information, data and techniques for fundamental design and analysis. Research Data The ESDU' Composites Series provides a collection of 'Data Items' and programs for use in the design of fibre-reinforced laminated composite materials. Following these successes, composite materials were used for the entire tail structure of the A320, which also featured composite fuselage belly skins, fin/fuselage fairings, fixed leading- and trailing-edge bottom access panels and deflectors, trailing-edge flaps and flap-track fairings, spoilers, ailerons, wheel doors, main gear leg fairing doors, and nacelles. The AV-8B Harrier GR7 has composite wing sections and the GR7A features a composite rear fuselage. Composites enabled a 20 percent saving in weight along with a lower production time and improved damage tolerance. These applications include failure criteria, plate vibration and buckling, analysis of bonded joints, and stress concentrations, in addition to the calculation of basic stiffnesses and stresses, and built-in thermal stresses. Better known man-made composite materials, used in the aerospace and other industries, are carbon- and glass-fibre-reinforced plastic (CFRP and GFRP respectively) that consist of carbon and glass fibres, both of which are stiff and strong (for their density), but brittle, in a polymer matrix, which is tough but neither particularly stiff nor strong. The ESDU Composites Series includes guidance on the factors influencing the design and suggests methods of achieving the desired solution. Except in very special cases, the laminate will still be anisotropic, but the variation in properties with respect to direction will be less extreme. 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This complicates the design process and is often difficult to select a route to the best combination of geometry and material. This anisotropy is surpassed by layers of stacking, each often only fractions of a thick millimeter, on top of each other with the fibers oriented in different angles to form a laminate. Boeing 777, whose single flight was 10 years old, is about 20 percent of weight composites, with composite materials being used 4 € a €

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