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THE USE OF POLYMER COMPOSITES IN AVIATION
ИСПОЛЬЗОВАНИЕ ПОЛИМЕРНЫХ КОМПОЗИТОВ В АВИАЦИИ
ПОЛИМЕР КОМПОЗИТТЕРІН АВИАЦИЯДА ҚОЛДАНУ

Abstract. The article discusses the main composite materials in aircraft construction and their features. Honeycomb fillers, their design, ensuring the minimum mass of structures, maximum strength, rigidity, reliability, durability when working under heavy loads, at high temperatures and in aggressive environments, are composite materials.
Keywords: composite materials, honeycomb fillers, polymers.

Аннотация: В статье рассмотрены основные композиционные материалы в самолетостроения и их особенности. Сотовые наполнители их конструкция, обеспечение минимальной массы конструкций, максимальной прочности, жесткости, надежности, долговечности при работе в условиях тяжелых нагрузок, при высоких температурах и в агрессивных средах, являются композитные материалы.
Ключевые слова: композиционные материалы, сотовые наполнители, полимеры.

Аңдатпа: Мақалада ұшақ жасаудағы негізгі композициялық материалдар және олардың ерекшеліктері қарастырылған. Балға арналған толтырғыштар, олардың құрылымы, құрылымдардың минималды массасын, максималды беріктікті, қаттылықты, сенімділікті, ауыр жүктемелерде, жоғары температурада және агрессивті ортада жұмыс істеу кезінде беріктікті қамтамасыз етеді.
Түйін сөздер: композициялық материалдар, ұялы толтырғыштар, полимерлер.

Introduction

The main class of materials that satisfy rigid, often conflicting requirements, such as ensuring the minimum mass of structures, maximum strength, rigidity, reliability, durability when working under severe loading conditions, at high temperatures and in aggressive environments are composite materials.

The modern science of composite materials owes its dynamic development over the past decades, mainly, the use of composites in rocket technology and aircraft construction. (Fig. 1)

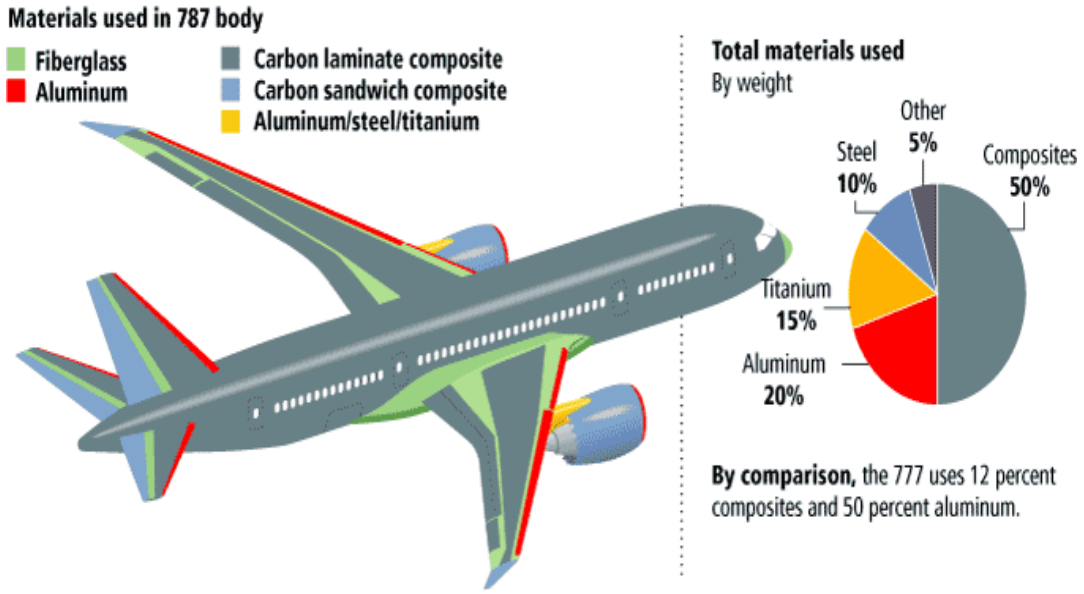


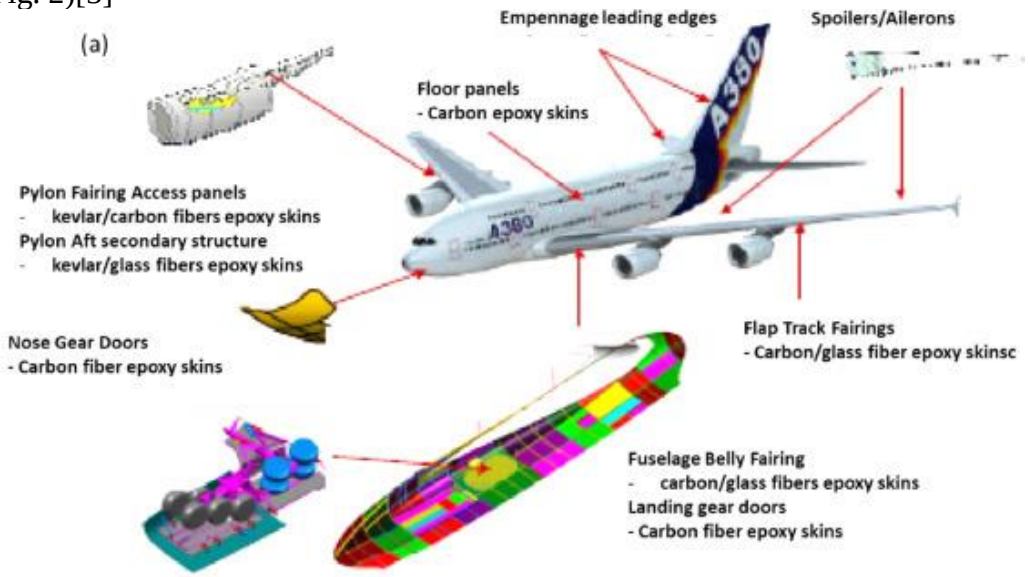
Fig. 1*- composites used in aircraft*

POLYMER MATRICES. The polymer matrix for composite materials is chosen taking into account the operating conditions of the products. The properties of the composite significantly depend on the matrix material: strength, heat and moisture resistance, resistance to the action of aggressive media, the method of obtaining the product. Polymers as a matrix are used either in pure form (powders, granules, sheets, films), or in the form of binders.[1]

The binder is a two- or multicomponent system of synthetic polymer and hardeners, initiators or catalysts, curing accelerators. In a binder with the aim of imparting necessary technological and operational properties can be added solvents, dyes, plasticizers, stabilizers and other components.

In the production of reinforced plastics, thermosetting binders are most often used, when heated, irreversible structural and chemical transformations; continuously the use of thermoplastic polymers and elastomers is expanding. Below is a brief description of the main types of polymers that have found application in the manufacture of PCMs.

A special form of composite materials is represented as follows called sandwich (honeycomb) structures. They are used in almost all types of civil and military aircraft and helicopters. (Fig. 2)[3]



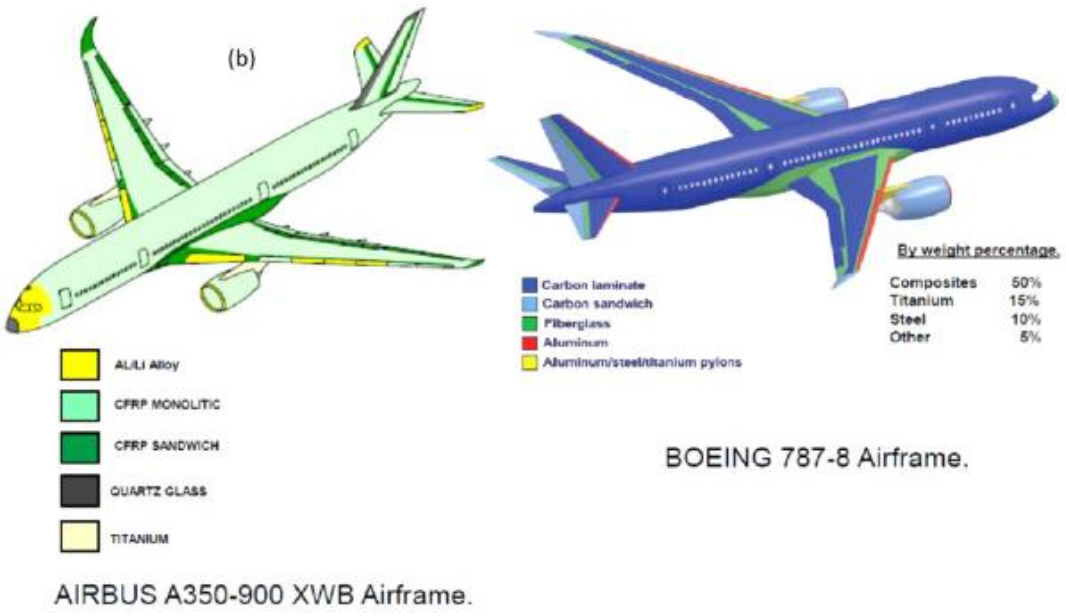


Fig. 2 *- Sandwich structures in A380 [144], (b) Sandwich and composite structures A350 and B787 composite Aircraft.*

The honeycomb structure contains two durable cladding plates, a core (lightweight rigid core) and two adhesive layers, connecting facing plates with filler having different cell shapes.

Materials of bearing (facing) plates in sandwich structures can be fiberglass prepregs, on based on carbon fibers, aluminum, titanium alloys, steel and another.

The main functions of the honeycomb are to ensure the stability of the bearing surfaces and transfer shear loads through the thickness of the composite. To successfully perform these functions the filler should be tough and lightweight. As material for for the manufacture of honeycomb fillers, wood can be used, metal, kraft paper, aramid paper, foam (expanded polystyrene, expanded metal). (Fig. 3)

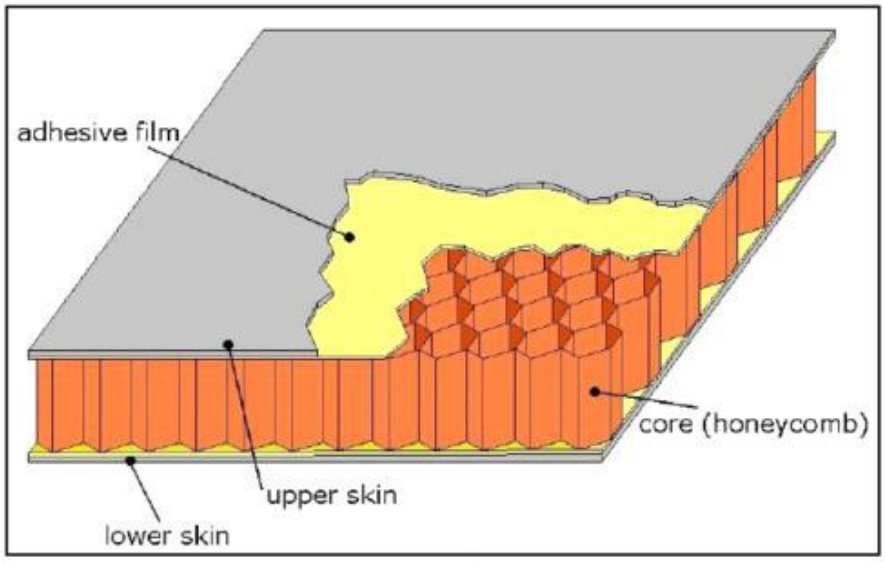


Fig. 3*- Honeycomb design of the shape of the cells of the filler*

Can be considered unique because with a relative increase in density of 6%, a change in the parameters of the structure led to an increase in its rigidity by 39 times. Honeycomb structures are produced using mainly two technological processes. The first is as follows: a package is assembled from sheet material, the sheets are interconnected, then assembled the bag is stretched to form a honeycomb structure. According to the second technology - initially, the process of corrugation of the original sheet (plastic, paper, metal) is performed, then the corrugated sheets are joined together by welding or gluing.

Conclusion

When using aluminum alloys, the density of the honeycomb filler obtained by stretching the package is32-192 kg / m3, and the filler obtained by the corrugation method is 128-880 kg / m3

Structural polymer materials are increasingly used in modern mechanical engineering, and their used in cases where no other material responds the ever-increasing requirements of new technology.

Currently, polymers and materials based on them are seriously pressed such basic structural materials as reinforced concrete, metal. The possibilities of polymeric materials are extremely wide due to the variety of polymers and fillers, the inexhaustible variability of the compositions of composites based on them and the methods of their modification.

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