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The Composite Materials a Way to Replace Traditional Materials

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ABSTRACT

New processes of design, industrialization and manufacture make it possible to extend the technical possibilities, and to better satisfy sometimes contradictory needs (weight, functions...) to which the traditional homogeneous materials answer with difficulty. The competition traditional materials-composite materials are guvernated by the necessity of conception news products with great applicability in different fields (aeronautical engineering, automotive engineering, railway industry, defense).
Keywords: *composite materials, properties, applications, traditional materials.*

1. Introduction

Contrary to the traditional materials of which one we know in advance the mechanical characteristics, those of the composites are not really known that after manufacture, because we realize, in same time, the material and the product.

In the more familiar world of metals, the mixing of different materials typically forms bonds at the atomic level (alloys), composites typically form molecular bonds in which the original materials retain their identity and mechanical properties. It is necessary to differentiate loads and reinforcements. A composite material is, by definition, any alloy or bulk material comprising reinforcement in filament form. It requires the association of at least two components: reinforcement and the matrix, which must be compatible between them.

This form of association introduce the concept of a connection, named the interface. The obtained materials are very heterogeneous and anisotropic. The properties of that new structure are dependant upon the properties of the constituent materials as well as the properties of the interface. Loads, in the form of fragmentary elements, powders or liquid, modify a property of the matter to which one adds it (for example there behavior with the shocks, resistance to UV, the behavior in fire).

Reinforcements, in form of fibers, only contribute to improve the mechanical resistance and rigidity of the part in which they are built-in. The reinforcement may be realized with short fibers or continues fibers, which can be orientated by a direction, more coplanar directions, three or more space directions, for buildup strong plates or flexible braids orientated on one or more directions. This reinforcement is like an armature soldered in the outside with epoxy resins, absorbing the tensile stress on the fiber direction [1].

Currently, the composites with organic matrix represent more than 99 % of composites materials; however, there are also composites with inorganic matrix (metal or ceramics). Weights, anisotropy, plurifonctionnality are the properties required.

2. Benefits of composites

The very hard competition remainder between the composite solutions and traditional materials, having a considerable advance in terms of experiment and investment in the producers and the users. The composite materials (with metal, elastomers, polymers or ceramics matrices) offer to the industrialists and to the designer's new possibilities to associate function, form and materials, for the realization of news materials and systems.

Additionally, where metal alloys (steel, copper bronze, etc.) have isotropic characteristics (the same in all directions), composites can have

very selective directional properties to meet specific application needs. Thus, composites are typically highly engineered materials targeted at specific applications.

New processes of design, industrialization and manufacture make it possible to extend the technical possibilities, and to better satisfy sometimes contradictory needs (weight, functions) to which the traditional homogeneous materials answer with difficulty. The innovation is however often accessible, in the sector of the composites as in others, only with the companies able to support investments of research, development and industrialization increasingly. The constraints of productivity are transmitted by the clients and are amplified towards the suppliers. With the occasion of each industrial or normative decision, a class of components or systems can appear or disappear.

The strong added value of these achievements, the requirements in terms of equipment and high level competences, confer a role to them growing in the search of differentiation and competitiveness, key to success of the industrialists of the Western economies. The innovation seems a factor determining of the durable success of the companies, even if it is not enough to furnish proof to the consumer a significant increase in the selling prices. The financial aspects are increasingly considerable. A company must be able to offer to its shareholders and to its financial partners a competitive profitability and transparency.

The internationalization of the markets of materials of high technology is accelerated today by the impact of the groupings of manufacturers and suppliers - in addition competitor -who develop virtual places of market, gates of acquisition on Internet widening the sources of parts and components to many suppliers and supporting the technical compatibility The risk of marginalization for the companies which miss, or which sufficiently do not offer products differentiating, is significant. The question of specialized and qualified human resources, of a technological specialty is also to treat.

Composites offer many advantages over other materials. Within aerospace and marine markets, where exceptional performance is required but weight is critical, composites continue to grow in importance. The many advantages of composites may be summarized as:

- Stronger and stiffer than metals on a density basis (For the same strength, lighter than steel by 80 % and aluminum by 60 %, superior stiffness-to-weight ratios);
- Highly corrosion resistant;
- Essentially inert in the most corrosive environments;
- Electrically insulating properties are inherent in most composites (depending on reinforcement selected). Yet composites can be made conducting or selectively conducting as needed;
- Tailorable thermal expansion properties
- Tunable energy management characteristics (high energy absorption or high energy conductivity at designer's choice;
- Exceptional formability (Composites can be formed into many complex shapes during fabrication, even providing finished, styled surfaces in the process);
- Outstanding durability (Well-designed composites have exhibited apparent infinite life characteristics, even in extremely harsh environments);
- Low investment in fabrication equipment (The inherent characteristics of composites typically allow production to be established for a small fraction of the cost that would be required in metallic fabrication);
- Reduced Part Counts (Parts that were formerly assembled out of several smaller metallic components can be fabricated into a larger single part. This reduces manufacturing and assembly labor and time);
- Corrosion Resistance (The non-reactive nature of many resins and reinforcements can be custom selected to resist degradation by many common materials and in corrosive environments), [2, 3].

2. Some sectors of development of composites

Composites find their way into hundreds of new applications, from golf clubs and tennis rackets to jet skis, aircraft, missiles and spacecraft. Composite materials offer designers an increasing array of as a material and system solution.

At the same time, composite cost trends are highly favorable, especially when the total cost of fabrication is considered.

Processes such as pultrusion offer the means to convert composite materials into finished products in a single trip through the machinery.

2. 1. Automotive engineering

Composite sheet molding compounds allow the formation of complete automobile skin panels in a single stroke of a press.

The use of the composites in the automobile sector goes up at origins relatively old (the end of 1980), but spread only very recently, as show it recent decisions of the great foreign manufacturers (Volvo, Mercedes) to develop case and forage ladders.

The composites with thermoplastic matrix are, on the other hand, more and more frequent.

To show how composites have changed our world, look no further than under the hood of a modern car and realize that most of her components are made of composite materials. If the car is a Corvette, the entire body is made of fiberglass or carbon reinforced composite materials. At composite applications are for huge sonar domes for Navy ships and submarines. Tires are a composite of rubber and a reinforcing material such as steel or nylon, [3-5].

2. 2. Leisures and sports

One of the earliest and largest uses for composites was in the manufacturing of pleasure boats.

Also these new materials allowed to show a great creativity, while presenting interesting mechanics properties which has, on the whole, be at the origin of the recent development of modern sports. It is specifically by using new materials (moulded skis and not laminated) that Salomon became world co-leader of the material of ski, at the sides of an other French Nightingale.

The manufacturers of materials of sport and leisure for a long time adopted the composites, developed in particular by Technical Shappe and Ems Chemistry (Swiss).

2.3. Transports

The railway materials present many potential applications for composite materials, as show it: the recent development of the German company of pendular equipment of trains, Comtas (Germany), sector of excellence where the European researchers make now the project of Bombardier-ANF to produce wagons of composite structure.

2. 4. Electronics

The industrial equipments (boxes of storage, insulation) and the electronics component represent already 26 % of the market of the composites with organic matrix. The potential of the composites (combining for example electric and sealing properties) is significant. In electronics ceramic cases for microprocessors, recently introduced on the market, are used in the whole world. The composites play a growing role in the dental sector (implants) and biomedical (prosthetic materials), in spite of strong constraints of biocompatibility. The realization of musical instruments (pianos, harpsichords, violins and same accordions) can offer prestigious applications, [5].

3. Conclusions

Composites are all around us today. The composite materials (with metal, elastomers, polymers or ceramics matrices) offer to the industry and new possibilities to associate function, form and materials, for the realization of news materials and systems. Composite materials offer designers an increasing array of as a material and system solution. At the same time, composite cost trends are highly favorable, especially when the total cost of fabrication is considered. Composites find their way into hundreds of new applications, from golf clubs and tennis rackets to jet skis, aircraft, missiles and spacecraft. Due to their properties they can replace with success metals, alloys or ceramics in many traditional applications.

The competition traditional materials-composite materials are guvernated by the necessity of conception news products with great applicability in different fields (aeronautical engineering, automotive engineering, railway industry, defense).

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Materialele compozite, o modalitate de a inlocui materialele traditionale

Rezumat

Noi procese de design, industrializare şi manufactură fac posibilă extinderea posibilităților tehnologice, şi să răspundă nevoilor (greutate, utilizare) la care materialele tradiționale omogene răspund cu dificultate. Competiția materiale tradiționale-compozite este guvernată de necesitatea concepției de noi produse cu aplicabilitate mare în diferite domenii(aeronautică, industria de automobile, industria de transporturi, aparate).

Matériaux composites, une modalité de remplaces les matériaux traditionnels

Résumé

Des nouveaux processus de design, d'industrialization et manufacture font possible la multiplication des possibilités technologiques, et de répondre aux besois (poid, fonctions) auxquelles les matériaux traditionnels homogènes répondent avec difficulté. La comparaison matériaux traditionnels – matériaux composites est gouvernée par la nécessité de concevoir des nouveaux produit qui ont une grande applicabilité dans des différents domaines (aéronautique, l'industrie des automobiles, l'industrie des transports, les appareils)