"Research and Development of Advanced Fibers Composite Materials and properties"

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Abstract – Advanced composite materials (ACM) can be used not only light weight materials but also advance functions materials on New, structural functional integrated materials. The advanced composite materials play a vital are capable meeting the various requirements of the technical development in application of advanced composite materials such that's of (ACM) advanced fibers- boron, aluminum oxide (Al2O3), silicon carbide (Sic) and the cross sectional area of fibers. The matrix materials- polymers: thermoplastics and thermosetting, metals ceramics: carbon and graphite, and problems with using polymer matrix materials: properties of fiber and matrix materials and some of other advance composite materials. Fibrous composites and layered composite, bi-directional composite of (ACM) fiber and matrix systems: properties of fibrous composite. In this paper, the application and advance composite materials some typical work concerting row materials, manufacturing and processing design and analysis testing and briefly discussed.

Key words- Advanced Fibers, Ceramic fibers, boron fiber, glass fiber, properties of (AFCM).

1.INTRODUCTION Advanced composite materials (ACM) cannot be used not only as lightweight materials, but also advance functional materials or new structural function integrated materials, which of capable of meeting the various requirements of air vehicles' raising structural and technical developments of advanced composite materials. The (ACM) play a vital role in reducing the structural weight of vehicles raising structural efficiency and reliability and prolonging their service life. So they are excellent structural and functional materials. The evolution of materials: use of modern polymer composites during world war 2nd military application non-metallic shielding of radiomen (to house electronic redder equipments) Glass fiber reinforced plastic (GERP). The constituents functions of a matrix materials. Enhances some of the properties of the resulting materials and structural materials components (that fiber alone is not use structural components and able to impact) these properties such as transfer strength of lamina and impact resistance. So they are excellent structural and functional materials in aerospace industries and they represented the failure of aerospace materials. In other words, there would be no modern aerospace industries accelerate the development of (ACM) greatly. The research and development on high performance composite such as carbon fibers reinforced resin matrix composites composite. The application of advanced composite materials (ACM) has been extended to many different fields. In aircraft advanced composite materials (ACM) has been used fabricated many be structure from of the substructures, to the main frame of the structures, including vertical trail, horizontal trail wing, fuselage components of helicopters and so on. The (ACM) materials are used in components of Chinese fighters such as F-811 are carbon fiber and the bismaleimide resin of QY811 or 5405. The portion of (ACM) utilized in the total structure weight of Z-9 helicopter is about 25% use the Advanced composite materials. The closed cell rigid foam named divinycellth H60 from DIAB is adopted as the materials to be investigated.

2. ADVANCED FIBERS PRODUCTIONS AND PROPERTIES

2.1 Glass Fibers: The (ACM) ancient Egyptians' made containers from coarse fibers drown from heat softened glass (produce by extruding molten glass at 1200°C) passed through spinnerets of 1-2mm diameter then drawing the filaments to produce fiber of diameter between 1-5μm individual filaments is small in diameter, isotropic in behaviors' and variety forms and properties.

Fig.1 row material of glass fibers

Fig.2 product of glass fibers

E-glass fibers: high strength and high resistivity, S2- glass: high strength modulus and stability under stream temperature, corrosion in an acid environments, C- glass: resists corrosion in acid environments, R- glass: enhanced the mechanical properties, D- glass: dielectric properties internal, the glass fiber are isotropic in natures.

2.2 Carbon Fibers: Carbon fibers- carbon-carbon covalent bond is the strength in nature made the first carbon fibers Thomas Edison made carbon fibers from bamboo when experimenting for light bulb. Carbon fibers contains 80-95% of carbon and carbon fibers is produce 1300℃ made from two types of precursor materials (a) polyacrylonitrile (PAN) (PAN Based) (b) Rayon-pitch-residue of petroleum refining (pitch Based).

Fig. 3 Row matrial of carbon fibers

Fig. 4 Product of carbon fibers

Precursor fiber is carbonized rather than melting filaments are made by controlled pyrolysis (chemical deposition by heat) of material in fiber by heat treatment at temprature 1000℃ - 3000℃ different fibers have different morphology, origes shap and sizethe morphology is very dependent of manufacturing prosses. The size of individual filament ranges from 3 to 14μm hence very flexibles maximum temprature of use of the fiber renges from 250℃-2000℃ properties changes with temparature at high temparature. The maximum temparature of use of composite is controlled by the use temparature of the matrix modulus and strength is controlled by the process-thermal decomposition of the organic precursor under well controlled condition of temparature and stress thus carbon-fibers are an isotropic in nature.

2.3 Organic Fibers: Aramid fibers Aromatic polyamide family of nylons. Polyamide 6 = Nylon 6 and polyamide 6.6 = Nylon 6.6 melt spun from a liquid solution, morphology – radially arranged crystaline sheets resulting into anisotropic properties and the filament diamerters about 12μm and partially flexible high tensile strength intermediate modulus and very low elongation up to breaking pointof the organic fibers.

Fig. 5 Organic fiber plants

Fig. 6 Organic fibers

The lower strength in compression and du-point develop these fibers under the trade man kevlor from polyphenylene, terephthalamide (PPTA) Polymer.

2.4 Ceramic Fibers: Boron fiber it was the first advanced fiber developed stractural aplication ceramic monofilament fibers manufactured by CVD on to a tungesten core of 12μm diameter fiber it self is a composite fiber diameter rangs between 33 - 400μm and typical diameter is 140μm boron is brittle hence large diamerter inlower flexibility.

Fig.7 Ceramic fibers

Fig. 8 Boron fiber

The thermal coefficient mis match between boron and tungesten in thermal residual stresses during fabrical cool down to room temperature.

2.5 Aluminum oxide (Al2O3) these are ceramic fabricated by spening a slury mix of aluminum article and additives to form a yarn which is then subjected to controlled heating fibers ratain strength at high temerature.

3.1 RESULT AND DISCUSSION

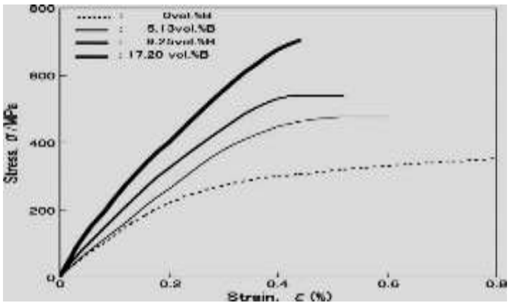

Fig. 9 stress / strain carve fiber

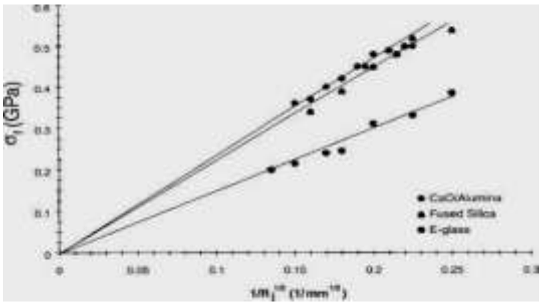

Fig. 10 stress /strain carve of glass fiber

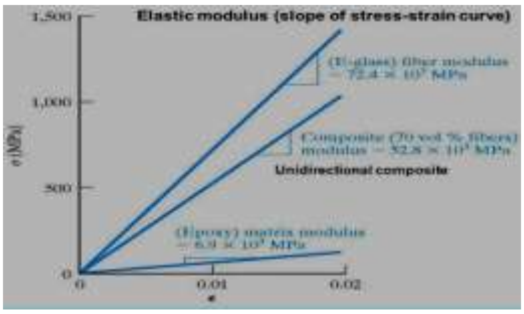

Fig.11 stress/strain carve Advanced fibers

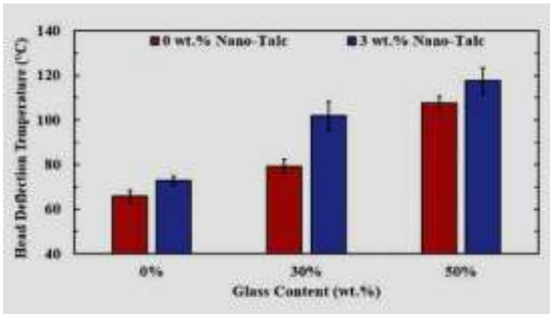

Fig. 12 mass constituentof glass fibers

3.2 Properties of Advanced fibers Composites Matrials (AFCM)

Materials	Density (ρ) g/cm^3	Modulus E	Poisson ratio μ	Strength σu	Specific stiffeness E/ρ	Speciffic strenght $\sigma u/\rho$	Therm. E. Coficient α
Boron	2.6	385	0.21	3799	5.8	8.3	8.3
Kevlar 49	1.44	124	0.34	3620	3.6	13.9	-2.0
SCS-6	3.3	400	0.25	3496	5.1	6.1	5.0
Nicalon	2.55	180	0.25	2000	2.8	4.4	4.0
Aluminum	3.95	379	0.25	1585	3.7	11.9	7.5
S2-Glass	2.46	86.8	0.23	4585	1.4	10.4	1.6
E-Glass	2.58	69	0.22	3450	1.05	7.5	5.4
Saphire	3.97	435	028	3600	4.3	5.1	4.8

IM8	1.8	310	0.20	5171	6.7	16.1	----
P100S	2.15	724	0.20	2199	13.2	5.5	-1.4
T300	1.76	232	0.20	3654	5.1	11.5	-0.5
AS4	1.80	236	0.20	3599	5.1	11.1	-0.8

CONCULUSION:

The paper has to be concluded the Advanced Fibers composites Materials (AFCM) the research and Development of summeried in this paper(AFCM). They have shown great potensial light weight Aerospace, aeronotics, spacecraft and other simillar applications and the improvement of Mechanical properties have accomplished the New types of Advanced Fibers Composite Materials which inclueded Carbon/Glass/Silicon/Organic Fibers/Ceramices/Carbon Fibers. In this work, above mentioned Fibers, and their impact response, and stress/strain behaviours mass density and other properties investigated and Numerical simulations. The final conculded in the paper is compare the mechanical properties.

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