RESEARCH AND DEVELOPMENT OF ADVANCED MATRIX MATERIALS COMPOSITES AND PROPERTIES

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Abstract – The continuous growth of composite Advanced Matrix Materials Composite (AMMC) the advance matrix materials composite is also known as binder materials. It provided the shape to the composite materials, to makes the composite materials generally resistance to adverse the environments. The advanced matrix material composite (AMMC) to protects reinforcement materials from adverse environments. The materials which constitute matrix of composite materials are Plastic, materials, ceramic, and rubber. The applications of aerospace aeronautics and similar uses the (AMMC) is low weight and high mechanical performance together with chemical resistance and fire/smoke behavior, are required. However despite their excellent specific Mechanical properties, their rupture process is generally speaking these Advanced composites denotes a resin-matrix material reinforced with high strength and high modulus. It is used for Combination of epoxy- resin matrix materials reinforced with oriented the Nature of its matrix (A) Advanced Composite Materials with Organic matrix (B) Advanced composites materials with metallic matrix (c) Advanced composites materials with Ceramics matrix.

Key words Advanced Matrix Materials Composite (AMMC), Plastic Matrix Materials Composite (PMMC), (MMMC), (CMMC), and Rubber Matrix Materials Composite (RMMC).

INTRODUCTION The Advanced Matrix Materials Composite (AMMC) is also known as binder materials it provides the shape to the composite materials to makes the composite materials generally resistance to adverse environments. The Advanced matrix materials composite protects reinforcement materials the materials which is constitute matrix of composite materials are plastics, metals, ceramic, and rubber. The plastic matrix based composite materials constitute more than 95% of composite materials today.

Both thermo sets as well as thermoplastics are used as matrix materials as thermo sets mostly exit in liquid state before cross linking it is very convenient shape the product and core it into solid thermoplastics, on the other hand have to be heated and liquid fiend for adding, inserts the Advanced Metal matrix Composite (AMMC) metal can also be reinforced with high strength fibers in order to improve the strength and stiffness (young s modulus). However it reduces elongation and toughness boron reinforced aluminum is very popular for aircraft applications advanced ceramic composite materials (ACCM) ceramic carbon and glass are widely used for this purpose the introduction of fibers or into ceramic improves tensile strength and toughness similarly Carbon/glass reinforced with carbon fiber have batter toughness.

The advanced rubber matrix composite (ARMC) of fiber or particulate filler enhances rigidity of rubbers, carbon block, cotton, Nylon and steel fibers are widely used for this purpose low density polyethylene (LDPE) and high density polyethylene (HDPE), polyamides, polyvinyl alcohol. The metal matrix composites (MMC) are of interest to day because the after opportunities to tailor a material with a combination of properties unavailable in a single materials i.e. combining the very high tensile strength and modulus of elasticity of various (MMC) are one of the strongest candidates for used as structural materials in many demanding environments as replacements to existing super alloys increase service temperature and improves specific mechanical properties.

The boron aluminum composite and graphite- aluminum /titanium composite (graphite reinforced aluminum titanium composite) are used for applications where thermal stability metal matrix composite and reinforced is very interesting for applications in the field of missiles, ordnance, electronics and space. The development of ceramic matrix composites (CMMC) by incorporation of Naturally occurring ceramic particles refractory particles like clay, zircon, shell, $TiO2$, $ZrO2$, mica, graphite, coconut, char, powder, flash and glass powder in aluminum/ aluminum alloys matrix has brought to the horizon a New class of composite.

2. Advanced Matrix Materials Composite (AMMC) developments and properties Applications.

2.1 Polymer Matrix Materials Composites (PMMC)

The thermoplastic: soften upon heating and can be reshaped with heat and pressure thermosetting become cross linked during fabrication and do not soften upon heating. The thermoplastics: polypropylene (PP), Polyvinyl chloride (PVC), Nylon, polyurethane, poly-ether-ether-ketene (PEEK), Poly-phenylene sulfide (PPS), Poly Subpoena, higher toughness, high volume low cast processing Temperature range ≥225℃. the thermo sets: polyesters, epoxies, polyamides, other the properties of polyester low cast, Good mechanical strength, low viscosity and versatility good electrical properties and good heat resistance, cold and hot molding the curing temperature is 120℃. The properties of epoxy: resins are widely used for most advanced composites low shrinkage during curing high strength and flexibility Adjustable curing rang, batter adhesion between fiber and matrix and better electrical properties, resistance to chemical and solvents.

Fig. 1 plastic molding machine set-up

Fig. 2 plastic Bords and sheets

Polyimides excellent mechanical strength retention for long term in 260℃ - 315℃ (500 - 600℉) range and short term in 370℃ (700℉) renge and excellent electrical properties good fire resistance and low smoke emission hot molding under pressure and quring temperature is 175℃ (350℃) and the 315℃ the polymer matrix materials. Susceptbility to environmental degardetion du to moisture

Radiation, atomic oxgen (in space) and high resudual stress due to large mismach in coefficients. Of thermal expantion both fiber and matrix. The polymer matrix can be used near or above the glass transition temerature.

2.2 Metal Matrix Material Composites (MMMC)

It is the (MMMC) higher temperature range Aluminum matrix composite use temperature range above 300℃ and Titanium at 800℃ highre transfer strength Toughness (in contrast with brittle behaviour of polymer and ceramics) the absence of moisture and high thermal conductivity copper

Fig. 3 row matrix materials

Fig. 4 product of metal matrix Material

Both are fig. 3 and 4 (MMMC) and Table 1 the properties of (MMMC)

Materials	Density ρ g/cm^3	Modulus EL	Poisson Ratio μ	Strength σu	Specific Stiffness E/ρ	Specific Strength $\sigma u/\rho$	Thermal E. C
Steel	7.8	200	0.32	1724	1.0	1.2	12.8
Aluminum	2.7	69	0.32	483	1.0	1.0	23.4
Titanium	4.5	91	0.36	758	0.95	1.2	8.8

2.3 Ceramic Matrix Materials Composite (CMMC)

There are carbon, silicon carbide and silicon Nitride ceramic use very high temperature range > 2000℃ and high elastic modulus and low density low weight and low cast materials the carbon and the carbon fibers in the carbon matrix-carbon/ carbon composite use under extreme mechanical loads (Space Applications) the properties of carbon matrix materials composite (CMMC) and low specific weight and high absorption capacity resistance to

Fig.5 row materials of ceramic

Fig.6 sheets form of ceramic materials

Damage. Exceptional Frictional properties at high energy levels resistance to high Temperature are chemical inert stress and low coefficient of thermal Expansion (excellent dimensional stability) but low resistance to oxidation above 500℃ and high cast of materials and manufacturing.

3. RESULT AND DISCUSSION MATRIX MATERIALS PROPERTIES

3.1 Properties graphically presented of matrix materials composites

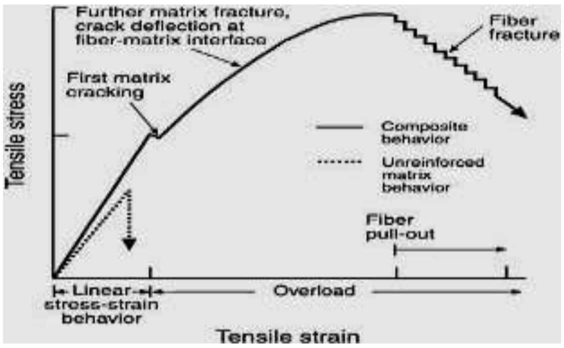

Fig. 7 Properties comparison

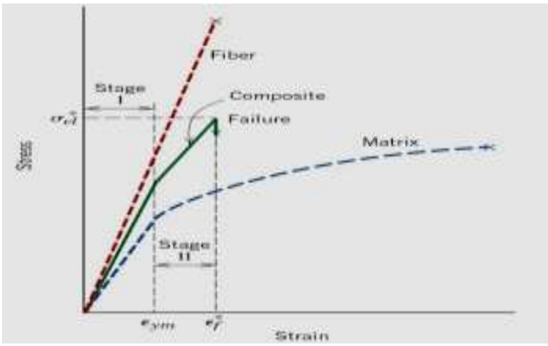

Fig. 8 stress/ strain of (AMMC)

3.2 Properties of Advanced Matrix Materials composites (AMMC)

Materials	Density ρ g/cm^3	Modulus E	Poisson Ratio μ	Strength σu	Specific Stiffness E/ρ	Specific Strength $\sigma u/\rho$	Thermal Expansion coefficient
Epoxy	1.38	4.6	0.36	58.6	0.08	0.4	63
Polyimide	1.46	3.5	0.35	10.3	0.03	0.03	36
copper	8.9	117	0.33	400	0.5	0.5	17
Silicon carbide	3.2	400	0.25	310	4.9	0.5	4.8

4. CONCLUSION

The Research and development of advanced composite materials for highlighted concerns include key materials and their processing technology, researching and developing of lightweight structural composites, matrix materials. The production cast is reduction and engineering utilization expanding of advanced matrix materials composite increasing the quota of aerospace, aeronautics' space in military application submarine industries. Low cast composite technique is another tendency for aerospace engineering, which includes the reduction of the cast in the whole fields of design, raw materials manufacturing evaluation and repairing.

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