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ANALYSIS OF EFFECT OF REINFORCEMENT IN FIBRE ORIENTATION BY USING HYBRID COMPOSITES (BRASS)

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ABSTRACT

Brass hybrid composites are a new generation of metal matrix composites that have the potentials of satisfying the recent demands of advanced engineering applications. These demands are met due to improved mechanical properties, amenability to conventional processing technique and possibility of reducing production cost of brass hybrid composites. The performance of these materials is mostly dependent on selecting the right combination of reinforcing materials since some of the processing parameters are associated with the reinforcing particulates. A few combinations of reinforcing particulates have been conceptualized in the design of brass hybrid composites. This paper attempts to review the different combination of reinforcing materials used in the processing of hybrid brass matrix composites and how it affects the mechanical, corrosion and wear performance of the materials. The major techniques for fabricating these materials are briefly discussed and research areas for further improvement on brass hybrid composites are suggested.

However there are several design and manufacturing challenges to be addressed before practically using them as structural components. In this work we demonstrate the design, manufacturing and testing procedure of variable stiffness vs composite cylinder made by hybrid composites.

1. Introduction

1.1 Concept of Composite

Fibers or particles embedded in **matrix** of another material are the best example of modern-day composite materials, which are mostly structural. **Laminates** are composite material where different layers of materials give them the specificcharacter of a composite material having a specific function to perform. **Fabrics** have no matrix to fall back on, but in them, fibers of different compositions combine to give them a specific character. **Reinforcing materials** generally withstand maximum load and serve the desirable properties. Further, though composite types are often distinguishable from one another, no clear determination can be really made. To facilitate definition, the accent is often shifted to the levels at which differentiation take place viz., **microscopic** or **macroscopic**. In **matrix**-based structural composites, the matrix serves two paramount purposes viz., binding the **reinforcement phases** in place and deforming to distribute the stresses among the constituent **reinforcement materials** under an applied force. The demands on matrices are many. They may need to temperature variations, be conductors or resistors of electricity, have **moisture sensitivity** etc. This may offer weight advantages, ease of handling and other merits which may also become applicable depending on the purpose for which matrices are chosen. Solids that accommodate stress to incorporate other constituents provide strong bonds for the reinforcing phase are potential **matrix materials**. A few inorganic materials, polymers and metals have found applications as matrix materials in the designing of structural composites, with commendable success. These materials remain elastic till failure occurs and show decreased failure strain, when loaded in tension and compression. Composites cannot be made from constituents with divergent linear expansion characteristics. The interface is the area of contact between the reinforcement and the matrix materials. In some cases, the region is a distinct added phase. Whenever there is **interphase**, there has to be two interphases between each side of the interphase and its **adjoint constituent**. Some composites provide interphases when surfaces dissimilar constituents interact with each other. Choice of fabrication method depends on matrix properties and the effect of matrix on properties of reinforcements. One of the prime considerations in the selection and fabrication of composites is that the constituents should be chemically inert non-reactive. Fig 6 helps to classify matrices.

1.2 Role and Selection of fibers

The points to be noted in selecting the reinforcements include **compatibility** with matrix material, **thermal stability**, density, melting temperature etc. The efficiency of discontinuously reinforced composites is dependent on tensile strength and density of reinforcing phases. The compatibility, density, chemical and thermal stability of the reinforcement with matrix material is important for material fabrication as well as end application. The thermal discord strain between the matrix and reinforcement is an important parameter for composites used in thermal cycling application. It is a function of difference between the **coefficients of thermal expansion** of the matrix and reinforcement. The manufacturing process selected and the reinforcement affects the crystal structure.

Also the role of the reinforcement depends upon its type in structural Composites. In particulate and whisker reinforced Composites, the matrix are the major load bearing constituent. The role of the reinforcement is to strengthen and stiffen the composite through prevention of matrix deformation by **mechanical restraint**. This restraint is generally a function of the ratio of inter-particle spacing to particle diameter. In continuous fiber reinforced Composites, the reinforcement is the principal load-bearing constituent. The metallic matrix serves to hold the reinforcing fibers together and transfer as well as distribute the load. Discontinuous fiber reinforced Composites display characteristics between those of continuous fiber and particulate reinforced composites. Typically, the addition of reinforcement increases the strength, stiffness and temperature capability while reducing the thermal expansion coefficient of the resulting MMC. When combined with a metallic matrix of higher density, the reinforcement also serves to reduce the density of the composite, thus enhancing properties such as specific strength.

1.3 Formulas

1.) Deflection, $\delta = {WL}/{48EI}$

where., δ- deflection

W- Load

L- Length

E- Young's modulus

I- moment of inertia= $\left(\frac{\pi}{64}\right) D^4$

2.) Stiffness= ${W}/{\delta}$

1.4 Calculated Value:

1. Young's Modulus:
   i) Pure Brass:
   E = 1.3 X 10^5 N/mm²
   ii) Concentric Matrix:
   E = 2.012 x10^5N/mm²
   iii) With Rod:
   E = 1.6034 x10^5 N/mm²

Stiffness:

i. Pure Brass = 40.96 N/ m
ii. Concentric Matrix = 31.364 N/m
iii. With Rod = 26.401 N/m

Table 1:Readings and calculated value

DEFLECTION	LOAD ON PURE BRASS	LOAD ON CONCENTRIC BRASS	LOAD ON BRASS WITH ROD
0.1	9.060	15.540	12.380
0.5	19.860	19.600	16.480
1.0	37.120	24.420	21.720
1.5	54.400	28.120	25.600
2.0	70.260	31.420	28.880
AVG	**40.960**	**31.364**	**26.401**

2. Results and Discussion

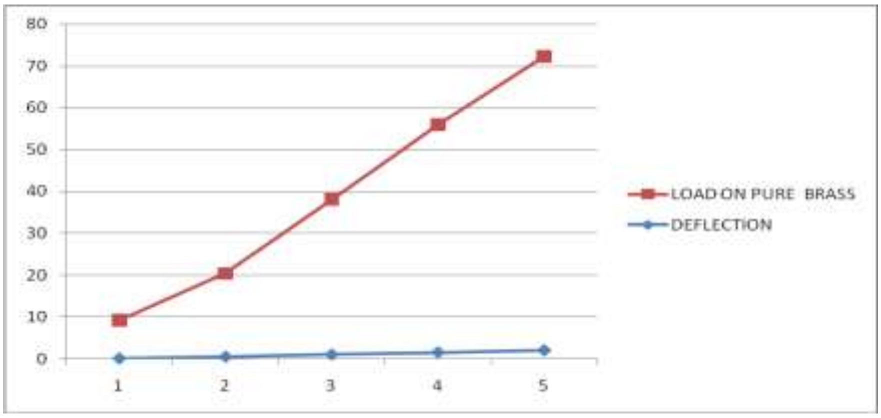

Figure 1 Load on pure brass

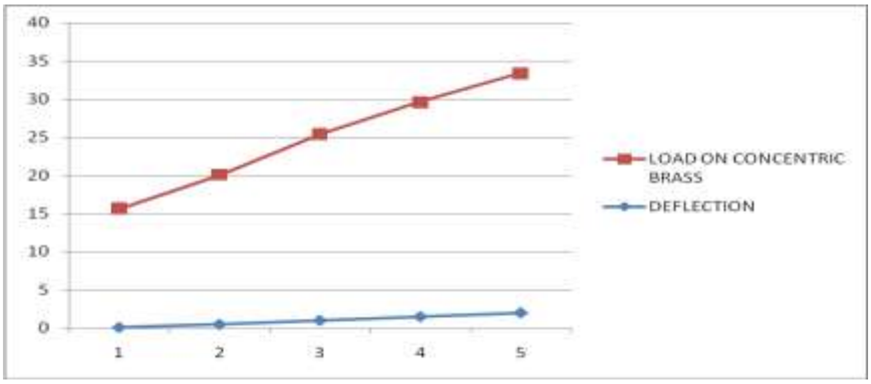

Figure 2 Load on concentric arrangement

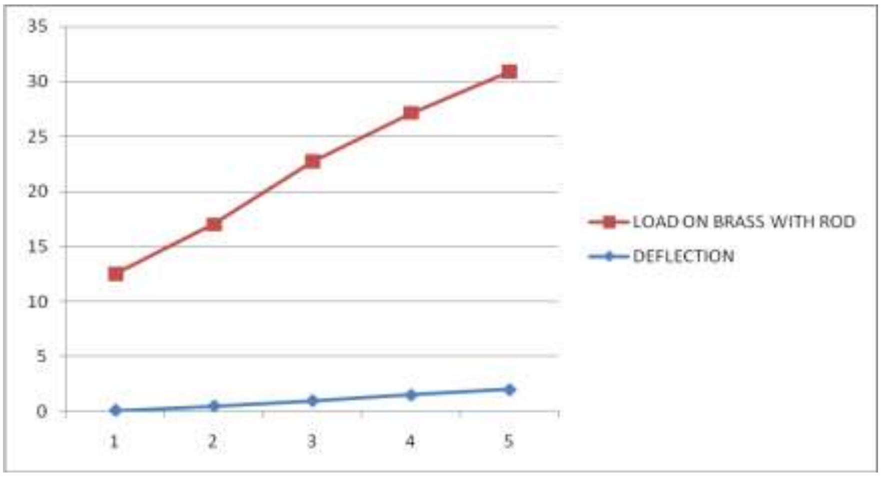

Figure 3 Load on steel matrix

- The material required for the concentric arrangement of brass with steel is half the percentage of material required for the arrangement of steel matrix.
- But the stiffness of the concentric arrangement of the brass is higher than the stiffness of the steel matrix arrangement.
- The strength of the material is higher in the concentric steel orientation.
- The concentric steel orientation has high young's modulus (doubled) than compared to the orientation with steel rod young's modulus.

3. Conclusion

From this project work it was concluded that

Analysed and calculated that the concentric steel orientation has high young's modulus (doubled) than compared to the orientation with steel rod young's modulus. The strength of the material is higher in the concentric steel orientation.