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Damping Properties of Composite Materials Reinforced by Silica, Graphite and Carbon Fiber.

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Abstract :*The research aims to study the Damping properties of composite materials consists of epoxy resin with phenolic formaldehyde resin reinforced by graphite or silica particles or both, and reinforced with carbon fibers of a standard format (-90, 0, +90). The results obtained showed that the Damping properties of epoxy-phenolic formaldehyde resins are enhanced after reinforced by silica, graphite and carbon fiber.*
Keywords: *Epoxy, phenol formaldehyde resin, particles reinforcement, carbon fibers, Damping properties .*

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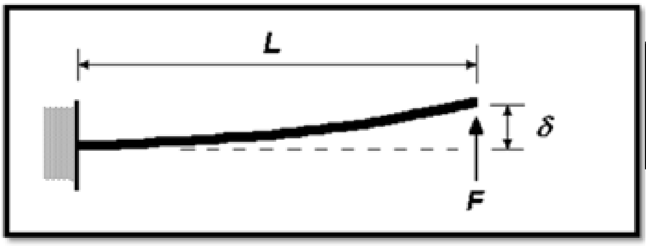
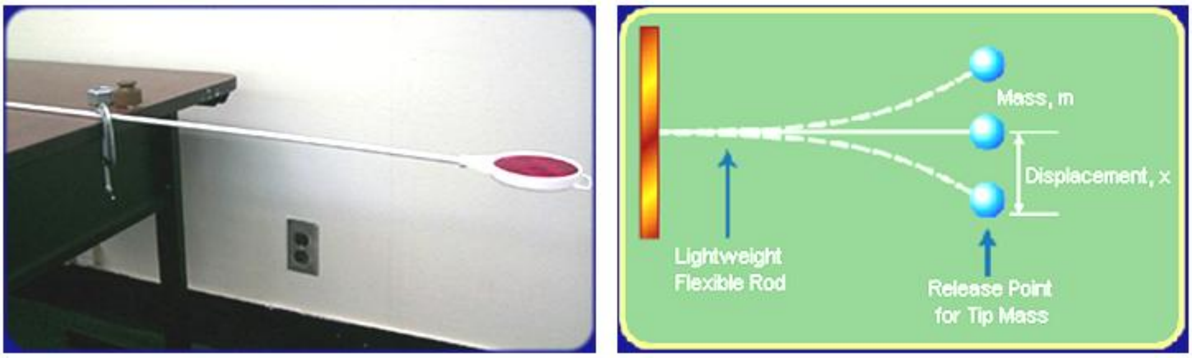
I. Introduction:

Shaky systems are all subject to suppression and varying degrees because there is energy to be driven by friction or heat or radiation leaking, or transmitted like sound. When the suppression is low, its effect on the natural frequencies of the system is secondary. Natural frequencies are then calculated on the basis of the absence of suppression. On the other hand, the suppression is of great importance in reducing the amplitude of the pulse at resonance. The vibrating system faces various types of damping forces, such as internal molecular The beam deflection depends on the length and shape of the friction, slip friction, and barrier resistance. [6]. cross section and the material used to shed the force as well as how to fix the penis [9].



The shape is a sling loaded at the end of the one-sided lever [9].

The deviation of the sample that is under the weighted load [9] depends on: *Value and type of pregnancy, *properties of the penis (elasticity), *Characteristics of penis shape (inertia torque , *the type of penis (fixed on the one hand and loose on the other (Cantilever), hanging. Natural Frequency, It is a number of times the system shakes between its original position and the site joking at it. For example, a simple beam can be taken from one end and contains a block bound to the loose end. As shown in the figure above, if the beam is pulled down and left, the beam will vibrate at its normal frequency. [7].



The figure shows a simple beam installed from one end containing a block bound to the bulk end [7].

It is possible to observe the overall behavior of all the overlays used, taking into account the lack of behavior on the condition or type of fiber (glass, copper or carbon). The large displacement (Y) of the sample seems to decrease Asia with the natural frequency of the various overlays [8]. It is possible to observe that each of the curves shown is a different superposition. The points with high displacement values (Y) are due to the deviation of the complexes that are supported by short fibers of all kinds, While the points with low (Y) values are long-fiber-reinforced compositions of different types. This can be attributed to the type of bond between the fiber and the base material[9]. This means that fiber reinforcement will improve the hardness of the base material in a way that depends on the arrangement of the fibers within it[10]. It is also possible to observe that the location of the values of Y in the curve depends on the nature of the fiber (the value of the elasticity of the single fiber). In addition, the overall behavior must be dependent on the strength of the bond between them. The curve can also observe the highest deviation values, which are displayed by short glass fibers that have a low elasticity coefficient[11]. While the lower Y values are shown by carbon fiber-supported overlays that have a greater elasticity coefficient than fiber glass or even copper fiber. These composite materials exhibit low normal frequency values. On the other hand, composite materials supported by long-lasting fibers have lower deviation values, as these materials have higher acidity, as they are supported by fibers with higher elasticity coefficients and therefore have lower deflection[12]. In general, this means that the state of the material in the interfaces of fiber interfering with the base material, has a significant role in attenuation of waves of vibrations passing through the overlapping material. Previous studies indicate that there is an exponential decline that represents a change between the degree of the instantaneous deviation of the shaky cantilever and the elastic coefficient of the overlapping lever material[8]. The points with high deviation values are those that are generally supported by Chopped Fiber, Extrusion ranges of overlapping levers supported by continuous long fibers are generally low regardless of the type of base material or supporting fiber material. This is why we call this behavior a totalitarian behavior not to rely on the type of material and fractions of its volumetric components[13].

II. Experimental Procedure

Material used: The material used in this work are: (1) Epoxy resin LEYCO-POX 103, (2) phenol formaldehyde (resole) resin, (3) graphite particles, (4) silica particles, and (4) carbon fibers.
Mixing process: The epoxy resin (75%) was mixed with phenol formaldehyde resin with the ratio (75:25)% as a matrix and the reinforcing material was three types as shown in Table.1:

The practical part includes preparation of raw materials and how to prepare them, as well as mechanical tests conducted on composite materials. The epoxy resin was mixed with phenol formaldehyde resin (called resole). Different mixing ratios were used to obtain samples as follows:

Specimen No	Specimen
ER1	(Epoxy/Resole) (65/35)%
ER2	(Epoxy/Resole) (75/25)%
ER3	(Epoxy/Resole) (85/15)%
ER4	(Epoxy/Resole) (95/5)%

Table.1: Composition of composite

*Material used:

The material used in this work divided to two matrix material: Epoxy resin ,Phenol formaldehyde (resole) resin. After the mechanical tests on the previous samples (different mixing rates), the best case was chosen, and at mixing rates: (Epoxy / Resole) (**75/25**)%
The selected samples will then be supported: (Epoxy / Resole) (80/20)% , With graphite or silica or both, as shown in the following table:

- secondary mixing:

	Epoxy (wt%)	Resole (wt%)	Silica (wt%)	Graphite (wt%)	Carbon fiber (wt%)
ER3	80	20	-	-	-
ER3+S+CF	51.2	12.8	16	-	20
ER3+G+CF	51.2	12.8	-	16	20
ER3+S+G+CF	51.2	12.8	8	8	20

The composite material (epoxy + resole) was selected by both graphite and silica, as it gave the best mechanical properties. The composite material (epoxy + resole), supported by both graphite and silica, is then combined with carbon fiber. Carbon Fibers (CF) : is a high-performance fiber that is widely used to support advanced polymer-based composites, because of : *Carbon fiber has the highest value in the coefficient of flexibility and durability compared with the all types of fibers.
* Carbon fiber has a variety of physical and chemical properties. *Fabrication of composite and fibers is relatively inexpensive. The final case is the composite material (epoxy + resole), supported by both graphite and silica, together with carbon fiber, as the ideal case
*All this mixing ratio reinforced by carbon fiber with volume fraction of 20% excepted ER3 .

III. Results and Discussion

The elasticity coefficient values for the supported compositions for the cut fibers are usually lower than the elasticity coefficients of the long-fiber-reinforced compositions. Conversely, the values of the deviations of the cut-off levers of the cut fibers are much higher than those of long fiber-reinforced levers. This indicates that the coefficient of elasticity of vibrating solid bodies is inversely proportional to the values of the deviation ranges of these objects. This is reflected in the extent to which the deviation ranges are affected by the values of the vibrational material. It is shown that the highest vibration offset is obtained by the composite materials supported by the cut fibers, while the lowest displacement at the same strength occurs in the long-fiber-reinforced composite material, indicating that the K-acidity in the case of composite materials supported by the cut fibers is less than the composite materials This indicates that the Yunk coefficient in the case of composite materials supported by cut fibers is lower than in the case of overlapping long fiber-reinforced materials, where K is directly proportional to the Yunk coefficient and so to the rest of the material. That is, each type of composite material has a particular pulse time although the transient vibration force is constant, which means that each type vibrates with a different Wd. It is therefore possible to say that the highest quenching value is obtained in the composite materials supported by the cut fibers while the value of the quenching is reduced in the composite materials supported by long fibers. It is also noted that the basic material used in the research is polymer (ie low coefficient of elasticity) so it is the role played by the fraction of particles and fiber that improve the values of the coefficient of flexibility, as the values of high elasticity will lead to high levels of suppression. Interference zones can play a major role in this process. The difference in elasticity coefficient (between the base material and the fiber) is that short fibers give relatively higher suppression values than long fibers, and this may be due to the random direction of short fibers which either Dispersion of incoming vibration paths at interstitial interference across the wave path during fiber, or dispersion of the next elastic wave by reflection in different directions. Either way will prolong the path of the wave, which will improve the possibility of suppression.

IV. Conclusions

1. Low values of Damping properties of phenolic formaldehyde resin.
2. The Damping properties of epoxy- phenolic formaldehyde resins are enhanced after silica and graphite reinforcement and carbon fiber reinforcement.
3. The values of Damping properties increase with the increase of the reinforcements wt.% additions.

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