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RESEARCH ARTICLE

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WATER TREATMENT FROM INDUSTRIAL WASTE

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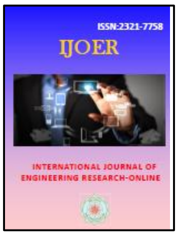


ABSTRACT

Current study was approved out to scrutinize the application of Compact jet loop reactor in the waste water treatment by using activated sludge process. The tests were carried out in the laboratory with synthetic waste water and the effluent from pharmaceutical industry. A laboratory scale Compact jet loop reactor model comprising of an aeration tank and final clarifier was used for this reason.

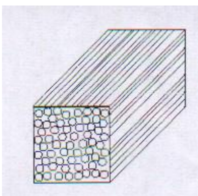
Keywords: Water treatment, waste water, BOD, COD, varied Liquor Volatile poised Solids.

1. Introduction

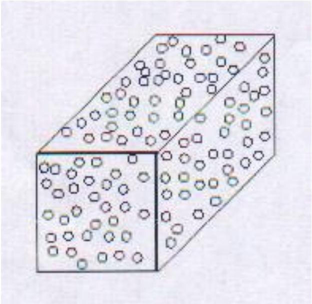
Through the last decades, contamination harms reached to an extent that the equilibrium entire ecosystem which is threatened. Water is the chief target of pollution. Activated sludge process has been used most widely among biological wastewater treatment process. In the present study, treatment of waste water was carried out by using activated slush process and investigated to reduce the level of pollution. Usually the extent of pollution is careful in terms of the Biological and Chemical Oxygen Demands (BOD and COD) as well as Suspended Solids (SS).

Established wastewater treatment plants are based on the use of selected mixed microbial flocs using recycling of settled biomass, resulting in the development of high performance reactors by increasing biomass concentration inside the reactors (A. Fadvi *et al*, 2005). Some other developments in this technology have resulted in more efficient and compact reactors able to perform better treatment with shorter preservation times. Some of these alternative technologies are based on fixed bed (P. Buffiere *et al*, 1995; M. Henze *et al*, 1993) fluidised bed (J. Iza, 1991) up-flow anaerobic sludge bed (UASB) (D. Daffonchio *et al*, 1998) and expanded bed (M. Perez *et al*, 1997) reactors and rotating biological contactors (L. Malandra *et al*, 2003). All of these use biomass flocs or.granules free or immobilized, as process catalysts, with the objective of increasing the biomass attentiveness inside the reactor for faster taking away of organic matter.

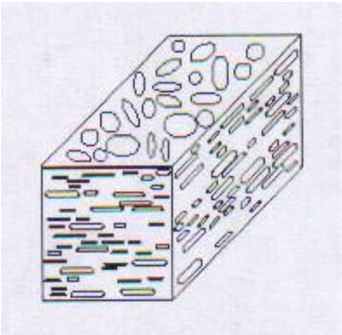
In the biological stage of waste water treatment plants, the dissolved organic pollutants (in the form of Carbon and hydrogen) are converted to sludge by microorganisms under addition of oxygen (aerobic) (E. A. Naundor *et al*, 1995). The type of tools used for the secondary treatment is big aeration basins containing either diffused or surface aerators. Recently there has been a shift from conventional treatment basins with a water depth of 3-4 m to large-size tower reactors of height between 15 and 30 m like the “Turmbiologie” of Bayer AG, the Biohoch_ Reaktor of Hoechst AG.



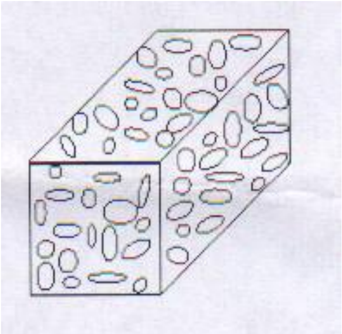
2. Particles as the reinforcement (Particulate composites):



3. Flat flakes as the reinforcement (Flake composites)



4. Fillers as the reinforcement (Filler composites):



2 Particulate – rein forced composite material.

In particulate – rein forced composites, discrete uniformly dispersed particles at a hard material are surrounded by a softer more ductile matrix. In fact the structure resembles that at many at the two – phase dispersion – strengthened metal alloys. We can subdivide the particulate composite materials into two general categories based on the size at the particles and the nature by which the particles influence the properties at the composite. These two categories include a) dispersion – strengthened composites and b) true particulate composites

2-1 Cermets

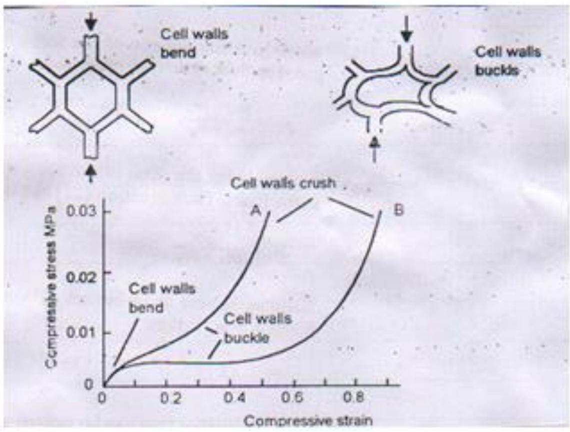
Cermets, or cemented carbides, are examples of particles- reinforced composites in which hard ceramic particles are in a metal matrix- the ceramics used have high strengths, high values of the tensile modulus and high hardness , but are brittle . By compression the metals are weakened less stiff but ductile . By incorporating ceramic particles, often about 80% by volume , in a metal matrix m a composite can be produced which is strong , hard and tough and can be used as a tool material . For example , tungsten carbide is very hard (about 2000 HV) ceramic with a high tensile module but also very brittle . Tools made from this material would thus be extremely brittle . a ceramic involving tungsten carbide in a metal matrix , cobalt can be made by mixing tungsten. Carbide powder s to a temperature above the melting pint of the compacted powders , after solidification the cobalt acts as a binder for the tungsten carbide. the composite has a better toughness then the tungsten. Carbide alone, jince crack propagation through the materials is hindered .when in use ,the tungsten carbide particles in the surface of the materials provide the tool with its cutting abating . as the tungsten carbide particles at the cutting surface become blunted ,they either fracture or pull out of the cobalt matrix and expose fresh tungsten cutting particles which can continue to provide cutting abiting .for a fine cutting tool ,the amount of the cobalt in the composite is low and the tungsten carbide particles fine so that the tungsten carbide particles pull out easily and the tool remains sharp. For a rough cutting tool, the amount of cobalt is increased to improve toughness' and coarser tungsten carbide particles.

2-2 particle-reinforced polymers

Many polymeric material in corporate fillers these being particulate examples at such filler are glass beads silica flour and rubber particles such fillers can be regarded as discontinuous fibers which have lengths comparable with their diameter. Their effect on the tensile strength and modulus at elasticity thus tends to be smaller

2-3 foams

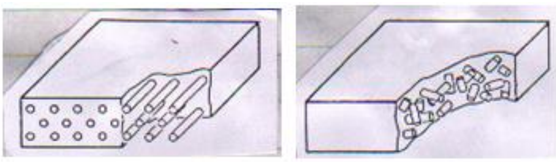
Foams are a particulate composite in which the component bound by the matrix is not solid but bubbles at a gas. Such foams are used cushioning in furniture energy. Absorbent packaging and padding for thermal insulation for buoyancy for structural panels and as filling sand which panels. The parameters determining the characteristics of foams are the ratio at the bulk density at the foams to that the uniformed matrix materials and the cellular structure of the foam. The foam can be open cell, closed cell or a mixture at the two. With closed cell structure . the gas bubbles in the foams are discrete and interconnected whereas in an open-cell structure the bubbles have coalesced and are inter connected structural foams and sand which or have solid skins covering the foamed core



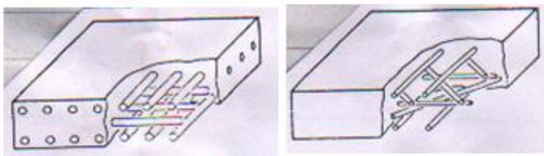
Stress –strain graphs for foamed polymers)

The fiber reinforced composites improve strength, fatigue, resistance, stiffness and strength –to-weight ratio by in corpora ting strong ,stiff, brittle fibers into softer, more ductile matrix .the matrix materials transmits the force to the fiber carry most of the applied force. Unlike dispersion-strengthened composites, the strength of the composite is increased both at room temperature and elevated temperature .

The reinforcing materials also are arranged in variety at orientations (figure 1-3),short. Randomly oriented glass fiber are usually present in fiber glass unidirectional arrangement at continuous fibers may be used to deliberately produce anisotropic properties fibers can be woven into fabrics or produced in the form of tapes can be changed in orientation



(a) (b)



d) (c)

(a)continuous unidirectional fibers

(b) randomly oriented discontinuous fibers

(c) orthogonal fibers and (d) multiple-ply fibers

The properties required of a suitable matrix materials are that

1- It adheres to the fibers surface so that forces applied to the composite are transmitted to that fibers so that they can assume the primary responsibility for the strength at the composite

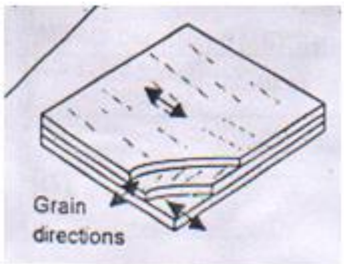
2- It protects the fibers surface from damage.

3-It keep the fibers apart to hinder crack propagation.

4- laminates

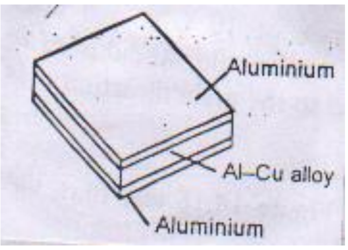
Laminates are composites in which materials are sandwiched together plywood is an example where then sheets of wood are bonded together to give a stronger laminated structure.

Plywood is an example of a laminated materials. It is made by gluing together thin sheets of wood with their grain directions at right angles to each other. the grain direction are the direction of the cellulose fibers in wood ,a natural composite and thus the resulting structure ,the plywood has fibers in mutually perpendicular directions thus, whereas the thin sheet had properties that were directional ,the resulting laminate has no such directionality.



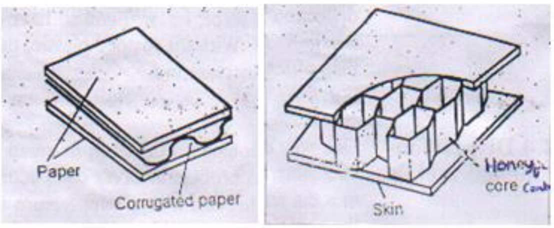
Fig(1-5): Plywood 3-ply

It is not only wood that is laminated ,metal are too. The cladding of an aluminum-copper alloy with aluminum to give a materials with better corrosion resistance is another example. Galvanized steel can be considered further example. the layer of zinc on the steel giving better corrosion resistance steel for use in food containers is often plated with tin to improve its corrosion resistance.



Fig(1-6):Clad alloy)

Corrugated cardboard is another form of laminated structure consisting of paper corrugations sandwiched between layers of proper. The resulting structure is much. Stiffer in the direction parallel to the corrugations than the paper alone. A Structure with a different sandwich core has an aluminum polymer of proper honeycomb structure sandwiched between then sheet of a metal or polymer. Such a structure has good stiffness and is very light and is often used for structural panels . anther form of sandwich panel has a core of low density e.g. a foamed polymer sandwich between two stronger and stiffer panels.

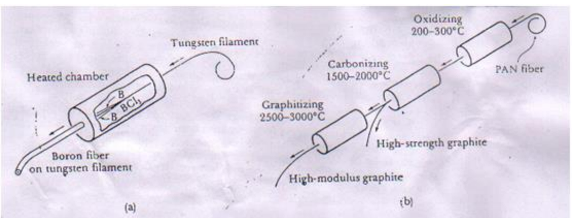


(a) (b)

Fig (1-7) (a)corrugated cardboard (b)honeycomb structure

Manufacturing fibers and composite

Fibers-coarse fibers , such as steel –reinforcing bar are produced by rolling finer fibers such as wire are made by wire drawing provided the materials possess sufficient ductility and strain-Harding characteristics tungsten ,beryllium ,strain less steel, and nylon can all be drawn to a small diameter .Boron and graphite are too brittle and reactive to be made by conventional drawing processes. Boron is produce by vapor decomposition (fig 1-8)

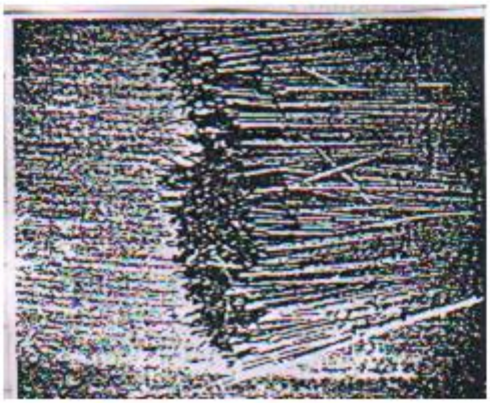


Fig(1-8) methods for producing
(a)boron (b) graphite fibers

A very fine, 0.0005 in heated tungsten filament is used as a substrate ,passing through a seal into a heated chamber . vaporized boron compound ,such as Bcls,are introduced into the chamber ,decompose and permit boron to precipitate on to the tungsten wire. the final fiber may be 0.001 in to 0.008 in .in diameter .

Graphite fibers approximately 0.0003 in .in diameter are made by carbonizing or pyrolizing an organic .filament which is more easily drawn or spun into thin continuous lengths (figure 1-9b) the organic filament known as a precursor is often nylon ,polyacrylonitrile(P A N) or pitch .high temperature decompose the organic polymer, driving off all of the elements but carbon. As the carbonizing temperature increase from 1000C to 3000C ,the tensile strength decrease while the modulus of elasticity increases . drawing the carbon filaments at critical times during carbonizing may produce desirable preferred orientations in the final graphite filament. The filament can be loosely woven into a yarn or two, which may contain hundreds or thousands of filaments (fig).

Whiskers, which are single crystals of exceptional fineness , are discontinuous,



Fig(1-9)A Scanning electron micrograph of a graphite two, containing many individual graphite filaments.

With aspect ratios of 20 to 1000. because the whiskers contain no mobile dislocations, slip cannot occur and the whiskers have exceptionally high strengths the technology for producing whiskers is very complex.

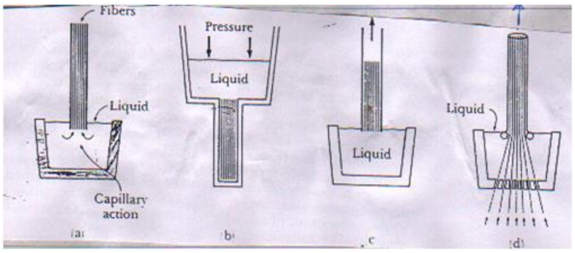
Composite

The fibers must be embedded in the matrix with the proper alignment and spacing to produce optimum properties . .discontinuous fibers can be mixed with the matrix material to produce either a random or preferred orientation continuous fibers are normally unidirectional aligned as tapes woven into a fibers in an orthogonal arrangement , or wound around a mandrel there are several techniques used to surround the fibers with the matrix,

-Casting:[1]

Casting process force liquid around the fibers pouring concrete around steel ,rein forcing reads that have been properly assembled rough example in the filament rein forced composite ,the liquid is interdicted around the fibers by capillary action vacuum in filtration ,or pressure casting fig(1_10).

Special casting on the fibers may be necessary to assure proper wetting of the fibers by the liquid matrix



Fig(1_10): Casting technigues for produce composite material (a)capillary rise(b)pressure casting ©vacuum infiltration and (d)continuous casting

2-prepregs:

When the fibers are woven into a fabric a polymer matrix is in filtrated into each fabric layer the infiltration is carried out under conditions such that the resin doesn't polymerize fig(1_11).

Later these prepress are stacked in layers , then heated under pressure so that the resin melt and polymerize to form the solid composite . the orientation of fabric layers can be arranged to produce varions cross. Plies of fibers.

Fig(1_11): Unidirectional aligned boron fibers in a tape prep egged with epoxy

3-tapes:

Individual fibers can be un wound on to a mandrel which determines the spacing of the individual fibers, and prep egged with polymer resin fig(1-12a)the tapes up to 48 in wide are joined to produce wider material or stacked to produce thicker material. Heat and pressure complete the polymerization process.

A metal matrix may be applied to a fiber using a molten metal bath , plasma spraying upper deposition or electrode position . the percolated fibers often in the form of tapes are then assembled and banded by other techniques .

5-deformation and diffusion bonding:

Deformation process such as not pressing and rolling join layers of tapes fig(1_12). Diffusion bonding is also used both for original introduction of the matrix to the fiber as well as for joining the fiber tapes. The tapes are stacked to the proper thickness then a combination of atoms from the matrix fills the voids at the interface to produce a dense composition .

6- Powder metallurgy:

The matrix powder is poured around the fibers and then compacted at high pressure to produce a powder compact. Sintering at high temperatures consolidates the powder to solid be done . in this case the powder compact is heated to a temperature between the liquid us and solid us while under pressure

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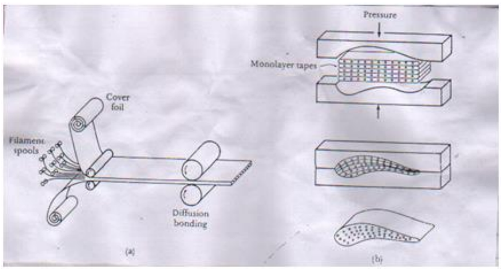


Fig (1_12): Solid _state techniques for producing composite include

(a) Rolling and diffusion bonding of tapes

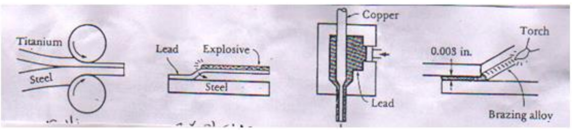
b) Pressing and simultaneous bonding of tapes(into shapes)

"Manufacturing laminar composites"

Several method are used to produce laminar composites including a variety of deformation and joining techniques fig(1_!3).

Rolling

Most of the metallic laminar composites such as claddings and bimetallic are produce by hotter cold roll bonding . if the percent deformation.



Fig(1_13): Techniques for producing laminar composite

(a) Roll bonding

(b) Explosive bonding

(C) Co extrusion and

(d) Brazing.

To great enough the pressure exerted by the rolls breaks up the oxides at the surface , brings the surface into atom to atom contact , and permits the two surface to be welded.

Explosive bonding _

An explosive charge can provide the pressure required to join metals, this process is particularly well suited for joining very large plate tat will not fit into a rolling mill.

Fig(1_14): A laminar composite of two aluminum plates and a steel plate formed by explosive bonding

Co extrusion

Very simple laminar composites, such as coaxial cable are produce by co extruding two metals through Adie in such a way that the self material surrounds the harder material similarly . Other maulstick polymer could be co extruded around a metal conductor wire.

Pressing

For small components high pressure at elevated temperatures provide welding . hot pressing is frequently used to cure the adhesive in laminates .

Brazing

Brazing cann join composite plate . the metallic sheets are separated by a very small clearance preferable about (0.003 in) . and heated above the brazing alloy . the molten brazing alloy is draw into the thin joint by capillary action.

Application of composite material

_application for particulate campsites

_application of laminar composites

Wood, concrete and asphalt, sandwich structure

Application for particulate composites

Particulate composites materials include many combinations at metals, ceramics and polymers. A number of these system will be discussed to illustrate the wide range of material, manufacturing process and application that are used.

Cemented carbides.

Cemented carbides contain hard ceramic particular dispersed in a metallic matrix tungsten carbide insert used for cutting tools in machining operations are typical of this group tungsten carbide wc, is extremely hard and can cut quenched and tempered Steels. The carbide is also very stiff so close tolerances can be held during machining,

And has a very high melting temperature ,so that high temperatures generated during rapid machining can be tolerated unfortunately , tools constructed from tungsten carbide are extremely brittle.

To improve toughness tungsten carbide particles are combine with cobalt powder and pressed into powder compacts. the compacts are heated above the melting temperature of the cobalt . the liquid cobalt surrounds each of the solid tungsten carbide particles (fig 2-1) after solidification the cobalt serves as the binder for tungsten carbide and provides good impact resistance as the tungsten carbide particles at the cutting surface become dull. They either fracture or pull out at the cobalt matrix and expose new sharp .edge particles that continue to provide good cutting . for finish machining, the amount of cobalt binder is intentionally reduced so the particles pull out easily and the tool remains sharp for rough grinding more cobalt is added to improve toughness.

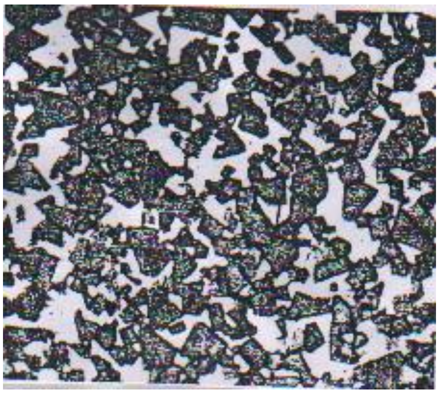


Fig.(2-1)microstructure of tungsten carbide 20%cobalt cemented carbide from metals hand book vol 7 8th Ed American society for material1972

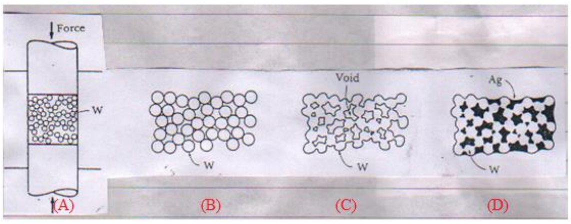
Abrasives

Grinding and cutting wheels are formed from alumina (al2o3)silicon carbide (sic),cubic boron nitride (bn)and diamond. To provide toughness the abrasive particles are bonded by a glass or polymer matrix .as the hard particles wear , they fracture or pull out at the matrix , exposing new cutting surfaces .

Electrical contact.

Material used for electrical contacts is switches and relays must have a good combination of wear resistance and electrical conductivity, otherwise, the contact erode causing poor contact and arcing , particulate composite ,such as tungsten reinforced silver provide material having the proper combination of hardness and conductivity .

A tungsten powder compact is made using conventional powder metallurgical presses (fig 2-2) producing high inter connected porosity . liquid silver is then vacuum in filtrated to fill the inter connected voids both the silver and the tungsten are continuous ,thus the pure silver efficiently conducts current while the hard tungsten provides wear resistance .



Fig(2-2): The steps in producing a silver tungsten electrical composite .

(a) Tungsten powders are pressed .

(b) Allow density compact is produced (c)sintering joins he tungsten powder , and (d)liquid silver is infiltrated into the pores between the particles.

Polymers

Many engineering polymers which contain filler and extenders are particulate composites.

A classic example is carbon black in vulcanized rubber carbon black consist of tiny carbon spheroids only 30 a to 5000 a in diameter the carbon black improves the strength ,stiffness , hardness, wear resistance, an heat resistance at the rubber.

Foundry molds and cores

Molds and cores used to make metal castings frequently consist of silica sand grains bonded by a matrix of either an organic or an in orgnicresin . the sand grains are refractory . insulating materials that do not react with the molten metal common binders include phenolic resins, urethane resins, furan resins and sodium silicate. The resins coat the individual sand grains and provide bridging fig(2-3).

The voids between the sand grains permit gases to escape from the mold rather than being trapped in the metal casting .

Fig(2-3) as canning microscope view of the bridging al ather mosetting polymer that binds sand grains in shell mold or core for the foundry industry note some fractured bonds.

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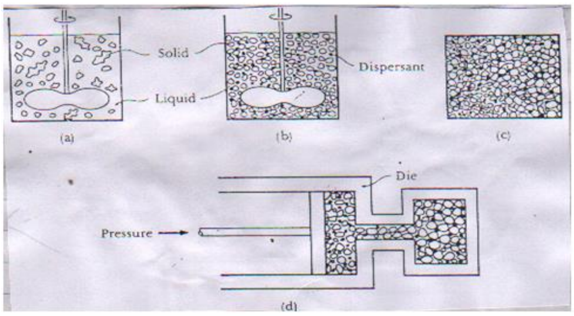
Compo casting .

One unusual technique for producing particulate reinforced castings is based on the thixotropic behavior at party liquid _ partly solid melt . a liquid alloy is allowed to cool until about 40% solids have formed; during solidification the solid _liquid mixture is vigorously stirred to break up the dendritic structure .fig(2-4)

The resulting solid _liquid slurry has thixotropic behavior _the slurry behaves as a solid when no stress is applied , but flows like a liquid when pressure is exerted.

If a particulate material is introduced to the molten metal during cooling and stirring , A uniform dispersion is produced. The thixotropic slurry containing the particulate is injected into a die under pressure; this process it termed compo casting.



Fig(2-4). Incompocasting (a) a solidifying alloy is stirred to break up the dendritic network (b)a rein for cement is introduced into the slurry c) when no force is applied , the solid_ liquid does not flow and (d)high pressures cause the solid_ liquid mixture to flow into a die.

Application of laminar composites

The number of laminar composites is so varied and their application and intentions are so numerous that we cannot make generalization concerning their behavior .

Laminates.

Laminates are layers at material joined by an organic adhesive a familiar laminate is plywood in which an odd number of wood veneer plies are stacked so that the grain is at right angles in each alternating ply the plies are glued by an adhesive such as aphenolio or amino resin . plywood permits wood products to be available in large sizes yet be inexpensive and resistance to splitting and warping.

Safety glass is a laminate in which a plastic adhesive such as polyvinyl butyric joins two pieces at glass ; the adhesive prevents fragments of glass from flying about when the glass is broken . laminates are used for insulation in motor , for making gears , for pinted circuit boards, and for decorative items such as Formica countertops and furniture.

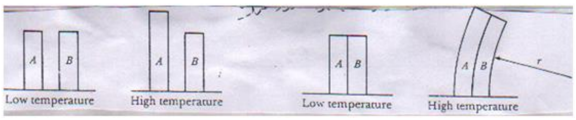
The adhesive laminates combine unusual characteristic include light weight flame retarance impact strength corrosion resistance , easy forming and machining , good ablative , and good insulation characteristics.

Hard surfacing .

Hard ware .resistant surface can be deposited on softer more ductile materials by fusion welding techniques known as hard surfacing hard surfacing alloys include hard enable grades of steel .Irons and steels that produce hard carbides cabalt _base alloys ,and certain nonferrous alloys. Composite tungsten carbide at the wear surface . similar welding procedure can improve corrosion resistance or heat resistance at surfaces.

Bimetallic.

Temperature indicator and controllers take advantage of the different coefficient of thermal expansion of the two metals in the laminar composite . if two pieces of metal are heated , the metal with the higher coefficient of thermal expansion becomes longer fig(2_6). If the two pieces of metal are rigidly bonded together , the difference in their coefficient cusses the strip to bend and produce a curved surface . if one end of the strip is fixed , the free end moves the amount of movement depends on the temperature; by measuring curvature or deflection of the strip , we can determine the temperature . Likewise if the free end of the strip activates a relay , the strip can turn on or off a furnace or air conditioner to regulate temperature



Fig(2-5)

7. Experimental work:

We can see form the particular work that there are many of parts we can make by using different materials by using special rules to reach to the final product that contain materials from polymers or ceramic or any other category.

The importance of composite materials are :

1. Composite can be designed that are very strong and stiff yet very light in weight, giving them strength to _weight and stiffness to weight and stiffness to weight ratios several times greater than steel or aluminum . these properties are highly desirable in application ranging from commercial aircraft to sport equipment .
2. Fatigue properties are generally better than for the common engineering materials toughness is often greater , too.
3. Composite can be designed that do not corrode like steel this is important in automotive and other applications.
4. With composite material it is possible to achieve combination of properties not attainable from metals , ceramics or polymers alone .
5. Better appearance and control of surface smoothness are possible with certain composite materials.

For all these point we can see that any properties easily make a combination from it is material to get the final product with the all properties needed.

In this research we take the combination between polymers and ceramic(fiber glass).

1. First piece

- the advantages of ceramics or the important properties are:

1. high hardness
2. good electrical and thermal insulating characteristics .
3. chemical stability.
4. high melting temperature.

So this is the properties of the first piece

Second piece:

It is type from the many types of polymer so the properties of this pieces are:

1. good strength to weight ratio for certain polymers
2. high corrosion resistance
3. low electrical and thermal conductivity.
4. rubbers are the type of polymers that interest with light weight.

-after combination to the above two pieces we get one final product carry all the properties of the two pieces which are from different materials.

-this combination was doing by using adhesive materials, here we use type of epoxy .between the layers.

-the work was by using one layer of polymer and put on it one layer of fiber glass adhesive by epoxy and repeat the working fig

The final product interest with many properties which are the combination between the properties.

First test:

Two layer of polymers and one layer of fiber glass.

-by making tensile test to the first piece we see that tensile test.

-the tensile test for fiber glass are small

- the tensile test for polymer are relative larger than fiber.

- the tensile test for the final composite materials are larger than the polymer and the tensile of fiber

hardness test:

-when we take the hardness pf fiber we see that it is very impossible because it is like papers so it is hardness is small .

-the hardness of polymer =Hpolymer=20

but the hardness of final composite material are H1=25;

And this applicator to other properties

Second test:

Three layers of polymer with two layers of fiber glass. When we repeat the above testing to the second product we can see that.

The hardness = H2=27

The tensile test =T2=

This equation is apply to find hardness after find D from the device.

$H=(1.8544*f)/d^2$

Reference

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