Juniper Online
Journal Material Science
ISSN: 2575-856X

Mini Review
Volume 5 Issue 3- March 2019
DOI: 10.19080/JOJMS.2019.05.555664

JOJ Material Sci

Composite Materials

Awham M Hameed*

Applied Sciences Department, University of Technology, Iraq

Submitted: February 04, 2019; **Published:** March 01, 2019

***Corresponding author:** Awham M Hameed, Applied Sciences Department, University of Technology, Iraq

Definition

Composite materials defined as mixtures of two (or more) components; combined physically with each other. One of these components called the reinforcing phase or the discontinuous phase while the other called the matrix or the continuous phase. The final forms of the reinforcing phase component could be particles, or flakes or fibers; while the matrix phase is a multiple; for example, polymer, metal or ceramic. There are so many practical examples of composite systems; such as a concrete reinforced with steel or epoxy resin reinforced with graphite hit fibers and many other examples.

Classification, Properties and the Important Applications of Composite Materials

The classifications of the composites depending meanly on the geometry of the reinforcement: whether it is particulate, flake, or fibers (Figure 1) or could be based on the nature of matrix phase: whether it is polymer, metal or ceramic [1].

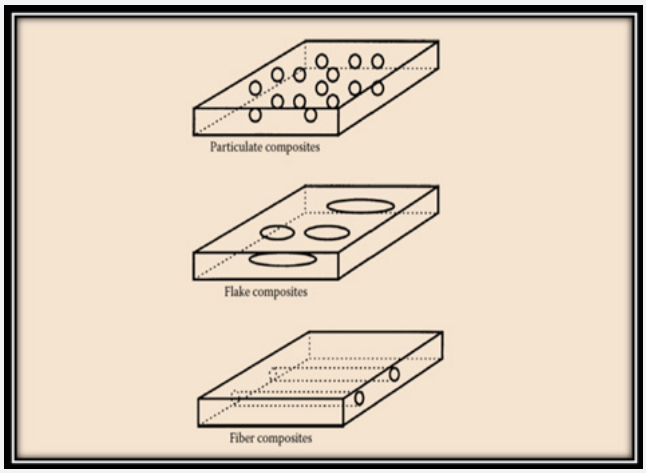

Figure 1: Types of composites according to the reinforcement form.

Polymer Matrix Composites (PMC)

PMC are considered as the most popular composites, comparing with the ceramic matrix composites or metal matrix composites; due to three reasons [2]; its lower cost; its high strength and easy to be fabricated. Despite this fact; PMC have its own disadvantages; mainly its low application temperatures, high amounts of thermal and moisture expansion coefficients and low Young's modulus values in some applications. There are a wide range of applications for PMC composites; It ranges from tennis racquets to the space shuttle parts and many other uses.

Metal Matrix Composites (MMC)

The well-known Metal Matrix Composites (MMC) are aluminum, magnesium and titanium composites. The ideal fibers that used for reinforcement of these composites are carbon fibers and silicon carbide (SC). MMC composites are recognized with several advantages comparing with PMC. MMC have higher Young's modulus; higher usage temperatures; larger values of electric and thermal conductivity; and better resistances to the wear, fatigue, and deformation [3]. The flaws of MMC comparing with PMC limited to their higher processing temperatures and higher densities. The automotive engines bodies could be manufactured from MMC; which recognized of their lighter weights. (boron/aluminum) composite tubes can be served as supporters for fuselage frame in space shuttle.

Ceramic Matrix Composites (CMC)

The CMC are recognized with their higher strength, higher hardness, higher application temperature, their chemical inertness, and their low densities in most high temperature

applications; CMC are come first because PMC and MMC cannot be utilized at such high temperatures [4]. CMC are used widely in manufacturing of cutting tools that insert within oxidizing and very hot ambient. Figure 2 shows some applications of composite materials.

Figure 2: Some applications of composite materials.

Hybrid Composites

Type of composites consists of more than one type of filler and/or more than one type of matrix material. They are commonly employed for modifying the properties and/or decreasing the cost of traditional composites for example the addition of a second type of fiber, such as glass or aramid fibers leads to increase the toughness value of the carbon fiber composite [5].

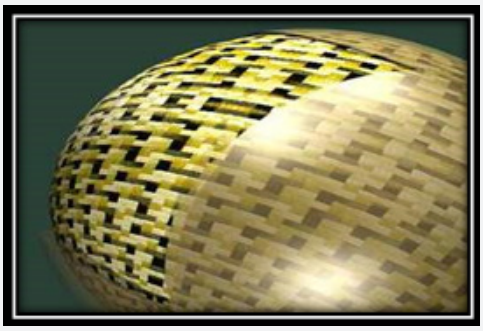

Figure 3: Carbon-Kevlar hybrid lamina.

Hybridization is defined as a process of incorporating different types of synthetic fibers in order to yield better strength, stiffness, higher (strength/ weight) ratio and other mechanical properties. Hybrid composites can be manufactured from a combination of natural/synthetic fibers, natural/natural fibers, or synthetic/synthetic fibers. This type is receiving attention from each of researchers and the industry for structural applications due to the impact properties of these materials. The applications of these composite are multiple such as their using in aerospace, automotive, and construction. Figure 3 shows (Carbon-Kevlar) hybrid lamina used in fabrication the hybrid composite. (Figure 3)

References

1. Campbell FC (2010) Structural Composite Materials. ASM International.
2. Nijssen RPL (2015) Composite Material, an introduction. A VKCN publication, Netherlands.
3. Hull D, Clyne TW (1996) An Introduction to Composite Materials. (2nd edn), Cambridge University, London, UK.
4. Autar K Kaw (2006) Mechanics of Composite Materials. (2nd edn), Taylor and Francis Group, CRC Press, USA.
5. William D Callister, David G Rethwisch (2013) Materials Science and Engineering. (9th edn), Wiley, USA.

DOI: 10.19080/JOJMS.2019.05.555664

How to cite this article: Awham M H. Composite Materials. JOJ Material Sci. 2019; 5(3): 555664. DOI: 10.19080/JOJMS.2019.05.555664