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# Assessment of Composite Waste Disposal in Aerospace Industries

N. Vijay[a,*], V Rajkumara[a], P Bhattacharjee[b]

[a]*Scientist D, DRDL.Hyderabad, India*
[b]*Scientist G, DRDL. Hyderabad, India*

**Abstract**

Composite materials are playing a vital role in aerospace industries due to its attractive thermal, mechanical and environmental properties. Especially, in aerospace applications where the weight factor is a concern, it offers good strength-to-weight ratio over metals, thus making a viable alternative. Apart from this, it gives high fatigue strength, light weight, increased corrosion resistance, improved fire resistance and also provides an ability to manufacture complex shapes. The steady increase in the use of Glass fiber/ carbon fiber composites has brought tremendous changes in aerospace industries. The diversified application of composite materials motivated the scientists to use in different fields where its predominant properties have given value addition to the product. However, it generates waste composite material during manufacturing as well as end of life. The composites waste should be collected, segregated and safely disposed as per the environmental legislation available in this country. Further, the waste generated by aerospace (defence& space) industry is minimum compared to the composite waste generated by the commercial industries. Composite waste disposal is relatively new area in India which is necessary to discuss for protecting the environment. Hence, selection of suitable environmental friendly as well as cost effective composite disposal method is necessary at this stage for aero space industries. In this paper, an attempt has been made to assess the existing disposal methods in the world and suggest suitable disposal method which is applicable for aerospace Industries.

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## 1.0 Introduction

Composite structures have been developed and applied for military applications over 50 years. At present the aerospace industrial applications are rapidly progressing from metallic parts and structures to composite materials

* Corresponding author.
*E-mail address:natesanvijay@gmail.com*


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due to its high strength to weight ratio. In general, three types of composite materials are developed and widely used in numerous kinds of engineering applications: polymer–matrix composites (PM), metal–matrix composites (MM), and ceramic–matrix composites (CM) (Yanget al.2011). According to the reinforcement types, composite materials can be classified into particulate composites, fiber reinforced composites, and structural composites. Two types of classifications are illustrated in Figure 1. For all types of composite materials, polymer–matrix is dominating the market, among which thermoset composites account for more than two thirds, however the thermoplastics composites are growing more rapidly in recent years. Fiber reinforced plastics (FRP) are lightweight, have high specific mechanical properties, are corrosion resistant, have long life cycles and are easy to manufacture in different shapes.

For these attractive properties FRP are increasingly being used in structural components, transportation/automobile industry and sporting goods. Even though, composite materials are having excellent properties, it produces hazardous gases and solid during disposal.

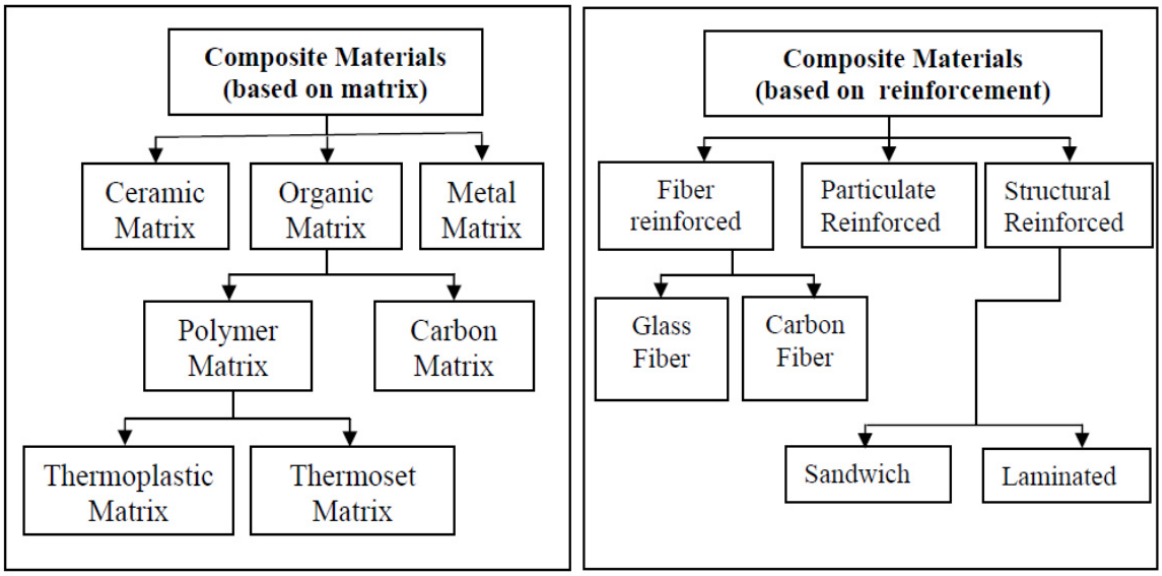


Fig. 1. Types of composite materials

## 2.0 Hazards of Composite Waste Disposal

The composite wastes are mostly disposed by incineration without knowing the hazardous nature of the ingredients of the composite material. The disposal process evolves toxic substances which may affect the living organism as well as the environment. Recent studies have identified a large number of hazardous chemicals that are adsorbed on particulates generated during incineration of material. Although the exact composition of chemical products is specific to the burning material, the spectrum of organic compounds includes nitrogenous aromatics, and phenolics. Several of these chemicals are known mutagens and carcinogens in animals, however, little is known about their toxicity when inhaled with particulate matter The toxic chemicals produced from the combustion of the organic resin from composites may be adsorbed on respirablefibers and enter the respiratory system with acute or chronic effects. Detailed toxicological studies are needed to assess the long-term health effects from exposure to single high dose of fibrous particulates and any synergistic interactions with the organic chemicals (Gupta 2009).

Boeing also addressed another issue for recycling and disposal of carbon fiber composites coated with hexavalent chromium primer. These composites are coated with hexavalent chromium and can be classified as hazardous waste and thus may/should not be disposed on land due to possible leaching of the chrome into the ground. This makes the recycling of such coated composite more challenging. It is clear and important that