

CHAPTER

6

BIOCOMPOSITE SIDE MIRROR HOUSING: CONCEPTUAL DESIGN

*Lin Feng Ng, Muhammad Nasrullah Non Harjar,
Muhammad Fitri Muhammad Fauzi, and Anahar Nurul Aina*

6.1 SUSTAINABLE DESIGN IN AUTOMOTIVE COMPONENTS

The design of various innovative products has been a frequently studied topic, as evidenced in previous studies (Ma et al., 2022). Innovative design can enhance product functionality and performance across various aspects. Composite materials can be defined as materials having at least two different solid phases (Khalid et al., 2021a). Efforts have been made to enhance the performance, cost-effectiveness, and quality of composite materials in order to meet technological requirements (Quanjin et al., 2019). Figure 6.1 summarises various types of composite materials available on the market. Among all composite materials, polymer matrix composites have garnered the most attention from researchers due to their simplicity in the manufacturing process, high specific mechanical properties, and the freedom to tailor their properties.

Natural fibres have been brought to the forefront as sustainable reinforcing materials for fibre-reinforced composites (FRCs) in recent years. Adding natural fibres as reinforcement to FRCs is a well-established approach for various applications (Hassanzadeh & Hasani,

2017). A continuous increase in research articles related to natural fibre-reinforced composites has been observed, indicating a notable interest in these fibres for developing green materials (Sun et al., 2021). Several promising characteristics of natural fibres, such as lightweight, superior specific properties, good recyclability and biodegradability, high availability, and low cost, have made natural fibres the preferred choice as reinforcing materials for FRCs (Kiruthika, 2024).

Today, they have been regarded as a viable option for conventional synthetic fibres. Their promising features offer them great potential to replace various synthetic fibres (Khalid et al., 2021b). Utilising those natural fibres from agro-industrial waste is crucial, as it could alleviate the disposal issues that contribute to adverse climate conditions (Silva et al., 2024). Despite their various fascinating attributes, natural fibres manifest several shortcomings that need to be resolved before they can be applied to engineering applications. Chemical treatments, hybridisation, and filler addition are common approaches used to effectively eliminate the demerits of natural fibres (Feng et al., 2020). Numerous research studies have reported the high effectiveness of these three approaches in uplifting the overall performance of natural fibre-based FRCs (Chandrasekar et al., 2022).

Due to the attractive features of thermoplastic polymers, a steady increase in the use of thermoplastic polymers as matrix materials for composites has been noticed. Figure 6.2 illustrates the main constituents in composites, along with their corresponding examples. Given the enhanced performance of natural fibre-based FRCs resulting from the aforementioned approaches, these approaches should be considered in the material design process to achieve the desired properties for specific engineering applications (Asyraf et al., 2022).

Fibrous polymer composites, particularly carbon fibre-reinforced polymer (CFRP), show promising advantages for industrial applications due to their high strength-to-weight ratio, wide market availability, and cost competitiveness in the modern manufacturing era. CFRP is the composite material that is symbolically known to have the strength of steel with the weight of paper. This is the reason why CFRP is the most popular material to suit the advanced application material requirements.

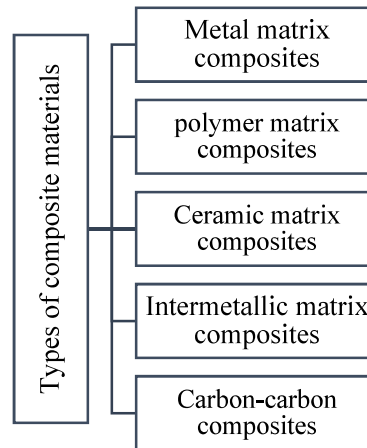


Figure 6.1 Classification of composite materials

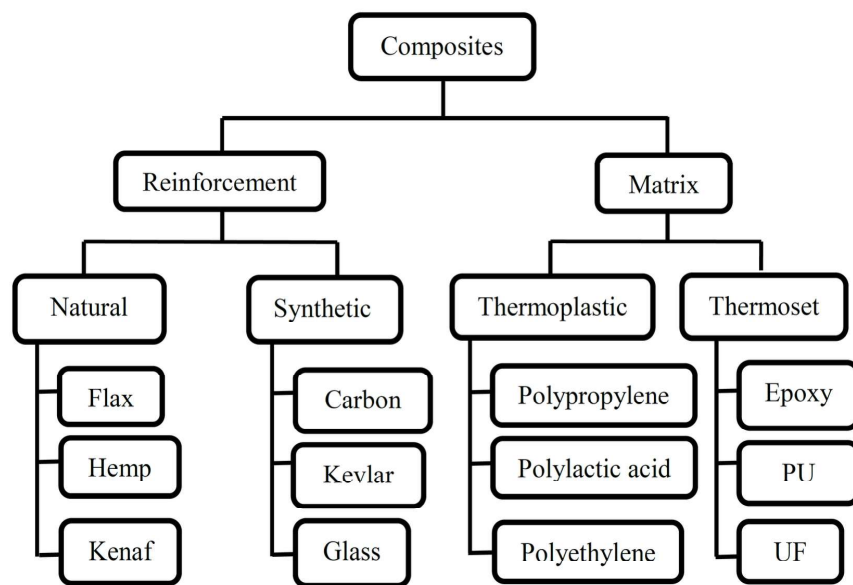


Figure 6.2 Classification of reinforcement and polymer matrix for composite materials