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DEVELOPMENT OF GREEN COMPOSITE FOR MARINE INDUSTRY

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ABSTRACT

Fiber-reinforced plastic (FRP) composites have been used for maritime applications for several decades and are becoming increasingly popular [1, 2]. Their primary benefits are corrosion resistance [3] and low weight, allowing emission reductions during operation. Alongside the rise in FRP material production and sales, there is also a rise in production waste and an impending exponential rise in the number of FRP products that will reach the end of their useful lives. In 2023, the European thermoset composites market wasted around 400 ktons per year of end-of-life [4] and with the maritime industry being the main source of FRP end-of-life waste. The structures of typical recreational boats are composed of carbon fiber or glass. One of marine industries goals is to make the boat more sustainable. In this paper, glass fiber was replaced with Natural fiber a more sustainable material. Low mechanical properties and hydrophilic behavior, make it a barrier for marine applications [5, 6]. 2D materials- graphene has excellent mechanical and water resistance properties [7]. Therefore, this paper presents developed a multiphase sustainable composite using graphene, flax fiber, and bio-epoxy. Graphene was used to coat the flax fiber. Various amount of graphene was utilized for the coating to analyze the effect of the amount on the performance of the composites. The laminates were fabricated using vacuum infusion molding. Physical and mechanical properties were examined according to ASTM standards.

The results showed that graphene coating has a crucial impact on the mechanical properties of the composites. As shown in Fig. 1, the flexural properties were increased in graphene-coated composites compared to uncoated composites. However, the amount of graphene played a key role in the performance of the composites. The lower amount of graphene (0.5 and 1.0 wt.% of fiber) showed a reduction in flexural properties, which indicates that the coating process harms the fiber surface and leads to poor load transformation in the composites. The high amount of graphene, 1.5 wt.% of Fiber displayed significant improvement in flexural properties, which that shows graphene particles successfully enhanced interface bonding between fiber and epoxy in the composite. The flexural strength and modulus were increased by approximately 37 % and 48 % respectively.

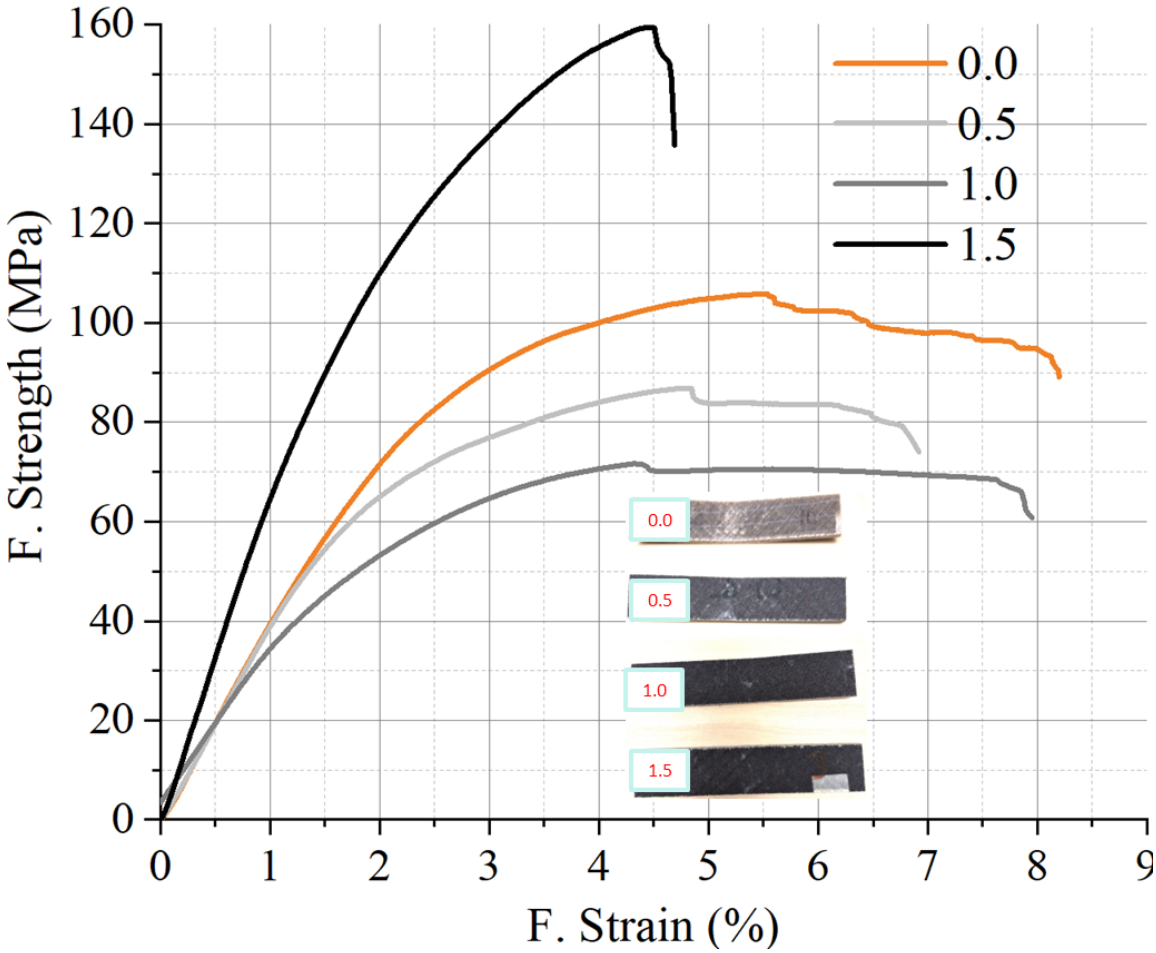

Fig.1: Flexural properties of developed green composites

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