Invited Talk

Sustainable Manufacturing of Carbon Fibers

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ABSTRACT

Carbon fiber and its composites promote sustainability by reducing component weight and carbon footprint. However, the production of carbon fibers is not a sustainable process, as it involves fossil-based feedstocks such as polyacrylonitrile (PAN) and is energy-intensive [1]. The demand for carbon fiber composites is very high today due to their outstanding mechanical properties. Use of PAN-based carbon fibers is primarily limited to high-tech sectors, such as aerospace, due to their high production costs. Functional applications of carbon fiber, such as structural batteries and EMI shielding, do not require high-strength carbon fibers. Also, the automotive industry seeks to use low-cost carbon fibers. For them, PAN-based carbon fiber is not a sustainable solution, and they urge the commercialization of alternative precursors derived from renewable feedstocks, such as lignin and cellulose, to enhance the process's sustainability and circularity [2]. Bio-resourced lignin-based carbon fibers, as sustainable options, are well-suited for low-structural and functional applications. However, lignin's structural complexity and dependence on feedstock and isolation methods require comprehensive characterization to realize its potential fully [3]. This paper focuses on the green production of carbon fibers by optimizing precursor fiber quality, developing an energy-intensive heat-treatment strategy, and replacing carbon-intensive chemicals and materials with their green substitutes to reduce carbon emissions.

Keywords: Carbon fiber, precursor, manufacturing, lignin

References

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