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INTERFACIAL MECHANICAL INTERLOCKING OF THERMOPLASTIC COMPOSITES

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The overwhelming majority of modern polymer materials are thermoplastics that are melt processed in an industrial setting. While thermoplastic based composites have the advantages of formability, recyclability, low cost and low weight, the problem of poor interfacial adhesion has hindered their application in the automotive, aerospace, and various other consumer and defense industries. In fact, the major thermoplastic materials such as polyethylene (PE) and polypropylene (PP) have low surface energy and form only weak van der Waals bonds with the fiber surface. To overcome this challenge, different physical and chemical approaches have been proposed to enhance adhesion, but without translational success. In this regard a computational study has been performed to explore the concept of enhancing the interfacial strength in thermoplastic composites via a controlled mechanical interlocking between fiber and matrix surfaces. The study proposes surface modification of the reinforcement phase in a glass/polymer composite system with various micro-architectural features. For instance, beads, voids, cavities, etc. could be realized experimentally for different reinforcement materials. Our computational results show that the concept of microarchitectural anchoring, which relies only on precise geometry and mechanical interlocking to transfer load at an interface, demonstrate translational potential.

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