Studies on unidirectionally oriented braided PEEK-PBO fiber-based novel composites for performance enhancement of PEEK

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High-performance polymer composites are well-known for their high strength, modulus, toughness, and ability to withstand high temperatures. However, processing these composites involving polymers like Poly aryl ether ketone (PAEK), Polyetheretherketone (PEEK) is associated with processing challenges since traditional techniques such as solution impregnation are not possible because they do not have a solvent. The commingling/braiding technique was opted in this study, which involves the two or more yarns of thermoplastic matrix fibers (such as Polyetheretherketone (PEEK), Ultra-high molecular weight polyethylene (UHMWPE), Nylon, etc.) and reinforcement fibers (Carbon, glass, Zylon, etc.) mechanically intertwined in such a way that the load is evenly distributed throughout the structure. In the commingled form, the matrix and reinforcement's multifilament yarns are dispersed at the fiber level. The present study explored the braiding/commingling technique to develop a composite of PEEK and Polybenzoxazole (PBO) fibers, (Zylon) in equal amounts followed by compression molding. The braided yarns of PEEK and Zylon were unidirectionally wrapped close to each other around a metallic frame and compression-molded under temperature and pressure to develop a composite. Physical, thermal, and mechanical properties of the composites, along with tribological performance was studied in adhesive wear mode. The developed composite exhibited superior performance in terms of % improvement compared to PEEK apart from wear resistance (≈ 90 %). The composite can be exploited for structural and tribological applications.

Keywords: PEEK, PBO, composites, tribology

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