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综述评论

三维机织复合材料力学性能研究进展

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摘要 对近年来关于三维机织复合材料力学性能的研究作了综述和归纳。研究表明，三维机织复合材料的力学性能不仅取决于纤维和基体的性能，而且与三维增强结构形式密切相关。通过对三维机织增强结 构的研究，获得了机织复合材料的细观结构和主要力学特征的关系，强调了增强纤维束轴向几何特征和截面形状对材料细观结构的重要影响。试验研究集中于观测机织复合材料的破坏模式，以分析三维机织结构对阻止损伤微裂纹扩展的贡献。理论分析方面较为成熟的研究是三维机织复合材料线弹性力学性能，其研究基础是层板理论模型、取向平均模型和有限元分析模型。而对强度及损伤方面的研究还有待于进一步的工作。本文对当前研究工作中的关键问题进行分析，并就今后的研究工作发表一些看法。

关键词 三维机织结构 纺织复合材料 细观结构 力学性能

分类号

PROGRESSING IN THE STUDY ON MECHANICAL PROPERTIES OF 3D WOVEN COMPOSITES

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Abstract

Recent research developments on mechanical behaviours of 3D woven composites are reviewed. It is shown that the mechanical properties of 3D woven composites depend not only on the respective properties of the constituent fiber and matrix but also on the goemetric structure of the 3D reinforcement. The relationship between mechanical properties of 3D woven composite and micro-structure of the reinforcement is discussed, especially the geometric pattern of the filament bundle and the shape of its cross section within the 3D reinforcement, which play an important role in determining the performance of the woven composites. Experiment investigations concentrate on the observations and analyses of the damage mode of 3D woven composite and the effects of the 3D reinforcement in preventing the propagation of micro-cracks inside the material. Modeling techniques are applied successively, based on the lamina theory, average orientation model and finite element analysis, to investigate the elastic properties of 3D woven composite. However, further work is still required before the strength and damage of the 3D woven composites can be properly predicted. Some suggestions for further investigations are also made in this paper.

Key words 3D woven structure textile composite micro-structure mechanical properties

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