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材料工程与机械制造

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### 3D针刺C/SiC复合材料螺栓的低成本制备及力学性能

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### Low Cost Preparation and Mechanical Property of Three-dimensional Needled C/SiC Bolts

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摘要

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#### 摘要

以三维针刺碳毡作为预制体,通过化学气相渗透(CVI)工艺,制备了密度约为1.50~1.60 g/cm<sup>3</sup>的半成品C/SiC复合材料板材,然后采用专用磨具在半成品复合材料板上按照指定的取样方式切割出螺杆与头部毛坯,并分别对螺杆和头部攻丝,将两者装配在一起形成半成品螺栓,对半成品螺栓CVI致密化并在其表面制备SiC抗氧化涂层,制备出低成本的3D针刺C/SiC复合材料螺栓。提出了C/SiC复合材料螺栓力学性能的测试方法,通过自行设计的夹具,对所制备螺栓的力学性能进行了测试表征,并利用扫描电子显微镜(SEM),对C/SiC复合材料螺栓的拉伸断口形貌进行了观测。结果表明,所制备的螺栓具有较好的抗拉和抗剪能力,室温下螺栓的抗拉强度和剪切强度分别为151.7 MPa和85.6 MPa。

关键词: 三维针刺 C/SiC 螺栓 制备 力学性能 化学气相渗透法

#### Abstract:

Semi-finished carbon/silicon carbide (C/SiC) composites plates with the density of 1.50-1.60 g/cm<sup>3</sup> are prepared by chemical vapor infiltration (CVI) of the three-dimensional needled carbon fiber preform. Then, stud and head blank of bolts are cut and tapped by special abrasive tools according to certain sample location from composites plates. By assembling the stud and head into a whole, the semi-finished bolts are subsequently obtained. Finally, the bolts are densified and SiC coating is deposited on surface of them by CVI. So, low-cost 3D needled C/SiC composites bolts are prepared. The methods are proposed to evaluate mechanical properties of C/SiC composite bolts and the mechanical properties are measured by special clamps. The rupture morphology are observed and analyzed by scanning electron microscope (SEM). The results show that C/SiC composite bolts have better mechanical properties. The tensile strength and shear strength of C/SiC composite bolts are 151.7 MPa and 85.67 MPa respectively.

Keywords: three-dimensional needled C/SiC bolts preparation mechanical property chemical vapor infiltration

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