

## 真空逸气对复合材料尺寸稳定性的影响

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## Effect of vacuum outgassing on dimensional stability of composite materials

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摘要

图/表

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**摘要** 为验证聚合物基体在真空环境产生的逸气效应对复合材料尺寸稳定性的影响,对环氧树脂和氰酸酯两种基体的碳纤维复合材料的真空逸气性能进行了试验研究。首先从理论上分析了膨胀系数与逸气系数之间的关系,获得了二者尺寸稳定性存在差异的理论依据。然后设计了能够精确测量尺寸和质量变化的试验组件,按照卫星环境试验条件对多组试验组件进行了3轮真空试验,精确测量了试验前后试验组件的尺寸和质量。试验结果表明:环氧树脂基体和氰酸酯基体的复合材料质损率(TML)分别为0.033%~0.06%和0.014%~0.029%;环氧树脂基体和氰酸酯基体的复合材料尺寸变化量分别为2~8 μm和1~3 μm。另外,环氧树脂基体的质量变化约为氰酸酯基体的2倍,说明两种材料在真空环境下的尺寸稳定性有差异。

**关键词** : 复合材料, 氰酸酯, 环氧树脂, 真空逸气, 尺寸稳定性

**Abstract** : To verify the influence of outgassing effects of polymer matrix in a vacuum environment on the dimensional stability of composite materials, this paper researches the outgassing properties of carbon fiber composite materials on the epoxy and cyanate resin matrixes. Firstly, the relation between expansion coefficient and outgassing coefficient was analyzed theoretically. Then, the test assemblies were designed to accurately measure their changes in the size and the mass. Finally, vacuum tests were carried out three times for several groups of test assemblies according to the demands of satellite environmental test conditions. Experimental results on the sizes and mass of these test assemblies show that the mass loss rates (TML) of epoxy matrix and cyanate resin matrix composite materials are approximately 0.033%—0.06% and 0.014%—0.029% respectively. Moreover, the size changes of epoxy matrix and cyanate resin matrix composite materials are about 2—8 μm, and 1—3 μm respectively. The mass change of the former is 2 times that of the latter, which means the dimensional stability of two kind of composite materials has different in the vacuum environment.

**Key words** : composite materials cyanate resin epoxy vacuum outgassing dimensional stability

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