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论文

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### 预制品结构对炭/炭复合材料氧化行为的影响

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### Effect of Preform Architectures on Oxidation Behaviors of Carbon/Carbon Composites

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摘要

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**摘要** 以短纤维树脂模压、炭布叠层和针刺毡为预制品,采用CVD方法制备了3种C/C复合材料,并研究了其氧化行为,计算了氧化反应动力学数据。结果表明在氧化失重率小于60%时,其氧化失重率与氧化时间呈线性关系,而且3种样品在700℃前后具有不同的表观活化能,由此导致不同的控制机制:700℃以下为动力学控制区,700℃以上为扩散控制区。C/C复合材料的氧化速率与预制品结构有关,这主要是因为不同的预制品结构导致形成了不同的热解炭组织,比较起来炭布/CVD炭复合材料的抗氧化性能最差,短纤维树脂模压/CVD和针刺毡/CVD炭复合材料具有较好的抗氧化性能。3种材料的氧化过程基本一致,都是首先从材料内空隙缺陷处开始氧化,伴随着碳纤维和基体炭同时氧化,碳纤维变得越来越细,最后基体炭只剩下很薄的一层,有的基体炭甚至已经氧化脱落而只剩下碳纤维裸露着,或者在碳纤维周围分布着极不均匀的多孔状热解炭。

**关键词:** C/C复合材料 氧化行为 预制品结构

**Abstract:** In this test, three kinds of carbon/carbon composites with short fiber resin molded, carbon cloth laminated construction and woven fabric preform architecture are prepared using CVD technology. The oxidation behaviors of the three kinds of carbon/carbon composites are investigated, and the oxidation kinetics data are calculated. The results show that when the weight lost is less than 60%, the relationship between the weight lost rate and oxidation time show a clear linear behavior, and the three kinds of composites have different apparent activation energies at about 700 °C, leading to the different domination mechanisms: the oxidation rates are controlled by the kinetics under 700 °C, and dominated by diffusion over 700 °C. The oxidation rates lie on the preform architecture due to different perform architectures forming different pyrolytic carbons, and the carbon cloth/CVD composite has a lower oxidation resistance capability than the others. The oxidation processes of three kinds of carbon/carbon composites are accordant on the whole, and the oxidation first takes place at the lacuna of the matrix, going with both the carbon fibers and the matrix carbon being oxidated at the same time. With progressive oxidation, the carbon fibers become more and more thin, and the matrix carbon leaves a very filmy bed only, some matrix carbons fall off from the fibers or some terribly asymmetric and porous matrix carbons are around the fibers.

**Keywords:** C/C composites oxidation behavior preform architecture

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