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## CVI炭/炭复合材料微观结构和生长模型

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**摘要:**采用自行设计的多元耦合物理场CVI炉增密炭/炭(C/C)复合材料,用炭毡作为纤维增强体,在坯体内部设计特殊的导电发热层,使坯体内部的温度场、气体反应的中间产物浓度场、电磁场等多元物理场实现耦合,实现坯体的快速增密。采用偏光显微镜研究沉积热解炭的组织结构;用X射线衍射仪研究C/C复合材料的石墨化度和微晶尺寸;用扫描电镜观察材料断口和热解炭沉积表面的形貌;并对CVI热解炭的生长方式进行研究。研究表明:获得SL、RL和带状等多种热解炭结构;不同的结构具有不同的形貌特征,其中SL的断口平整,RL的断口呈沟槽构造;并提出前者为小分子平滑生长模型、后者为大分子锥状生长模型。

**关键字:** 多元耦合物理场CVI; 炭/炭复合材料; 微观结构; 生长模型

## Microstructure and growth model of C/C composites by chemical vapor infiltration

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**Abstract:** Using carbon felt as porous performs, installing special electric layer in the performs forming the grads of temperature and electromagnetism, C/C composites were fabricated by chemical vapor infiltration (CVI) in multi-factor coupling physical fields. The textural of pyrolytic carbons were observed by polarized light microscopy (PLM), and the graphitization degree and microcrystal size of these C/C composites was analyzed by XRD. The micromorphology of fracture and deposition surface was observed by SEM. At last, two kinds of growth mode of pyrolytic carbon were put forward. The results show that rough laminar, smooth laminar and banded structure can be obtained, and their micromorphology, graphitization degree and microcrystal size exist different; The fracture appearance of SL is very flat and smooth, but that of RL is rough and more groove exists. The former is deposited by smoothness growth model of smaller molecule, the latter by taper growth model of bigger molecule.

**Key words:** multi-factor coupling physical fields CVI; carbon/carbon composites; microstructure; growth model

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