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CATALYTIC CHEMICAL VAPOR INFILTRATION OF CARBON NANOTUBE/NANOFIBER NETWORK REINFORCED CARBON/CARBON COMPOSITES: CATALYTIC EFFECT ON THE DENSIFICATION BEHAVIOR AND MATRIX MICROSTRUCTURE

Abstract

Carbon nanotube/nanofiber (CNT/CNF) network reinforced carbon/carbon composites were produced by film boiling chemical vapor infiltration from xylene pyrolysis at 1000 1100 C using ferrocene as catalyst. Their densification behaviors such as the mass gain, the deposition rate and the density profile were investigated. The microstructure of pyrocarbon (PyC) matrix and CNT/CNF was observed by polarized light microscopy, scanning electron microscopy and transmission electron microscopy. Results showed that, both the initial deposition rate of PyC and average density of the composites firstly increased and then decreased with the increasing catalyst content diluted in xylene from 0 to 2.0 wt%. The matrix of the composites was dominated by a single layer of rough laminar (RL) PyC for the catalyst content at 0 0.8 wt%, whereas a thin layer of isotropic (ISO) PyC was formed when the content was 1.2 wt%, and its thickness increased for the higher content at 2.0 wt%. CNT/CNF network can be formed in PyC matrix after adding catalyst, which exhibited a structural transition from CNT to CNF with the increasing catalyst content. The densification model and PyC formation mechanism were also discussed by analyzing the thickness profile of PyC layer and liquid intermediates of xylene pyrolysis, respectively.