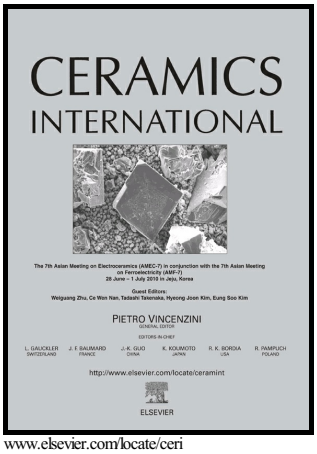
Hysteresis loops of carbon fiber-reinforced ceramic-matrix composites with different fiber preforms

Li Longbiao



www.elsevier.com/locate/ceri

PII: S0272-8842(16)31140-3
DOI: http://dx.doi.org/10.1016/j.ceramint.2016.07.073
Reference: CERI13298

To appear in: *Ceramics International*

Received date: 18 June 2016
Revised date: 11 July 2016
Accepted date: 11 July 2016

Cite this article as: Li Longbiao, Hysteresis loops of carbon fiber-reinforced ceramic-matrix composites with different fiber preforms, *Ceramics International* http://dx.doi.org/10.1016/j.ceramint.2016.07.073

Hysteresis loops of carbon fiber-reinforced ceramic-matrix composites with different fiber preforms

Li Longbiao*

College of Civil Aviation, Nanjing University of Aeronautics and Astronautics

No.29 Yudao St., Nanjing 210016, PR China

*Corresponding author; Email:llb451@nuaa.edu.cn; Tel.:+86 25 84895963.

Abstract The hysteresis loops of C/SiC ceramic-matrix composites (CMCs) with different fiber preforms, i.e., unidirectional, cross-ply, 2D and 2.5D woven, 3D braided, and 3D needled at room temperature have been investigated. Based on fiber slipping mechanisms, the hysteresis loops models considering different interface slip cases have been developed. The effects of fiber volume fraction, matrix cracking density, interface shear stress, interface debonded energy, and fibers failure on hysteresis loops, hysteresis dissipated energy, hysteresis width, and hysteresis modulus have been analyzed. An effective coefficient of fiber volume fraction along the loading direction (ECFL) was introduced to describe fiber preforms. The hysteresis loops, hysteresis dissipated energy and hysteresis modulus of unidirectional, cross-ply, 2D and 2.5D woven, 3D braided and 3D needled C/SiC composites have been predicted.

Keywords Ceramic-matrix composites (CMCs); Hysteresis loops; Matrix cracking; Interface debonding.

1 Introduction

Ceramic materials possess high strength and modulus at elevated temperatures. In spite of this, their use as structural components is severely limited because of their brittleness. Continuous fiber-reinforced ceramic-matrix composites (CMCs) obtained, by incorporating fibers in ceramic matrices, however, can be made as strong as metals,