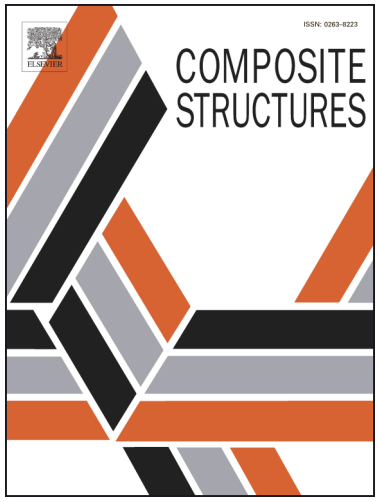

Fracture analysis on an arc-shaped interfacial crack between a superconducting cylinder and its functionally graded coating with transport currents

W.J. Feng, Z. Yan

PII: S0263-8223(17)31475-7
DOI: https://doi.org/10.1016/j.compstruct.2017.11.015
Reference: COST 9081

To appear in: *Composite Structures*

Received Date: 9 May 2017
Revised Date: 3 October 2017
Accepted Date: 6 November 2017

Please cite this article as: Feng, W.J., Yan, Z., Fracture analysis on an arc-shaped interfacial crack between a superconducting cylinder and its functionally graded coating with transport currents, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.11.015

Resubmitted to Composite Structures in Oct. 2017 (Modified Manuscript: No. COST_2017_1305)

Fracture analysis on an arc-shaped interfacial crack between a superconducting cylinder and its functionally graded coating with transport currents

W.J. Feng*, Z. Yan

Department of Engineering Mechanics, Shijiazhuang Tiedao University, Shijiazhuang 050043, PR China

Abstract In this study, an arc-shaped crack between a homogeneous superconducting cylinder and its functionally graded coating is investigated subjected to transport currents. The extended generalized Irie-Yamafuji critical state model in the coating is put forward. The distributions of both current and flux densities in the superconducting composite are presented for the processes of both transport current ascent and descent. The stress intensity factors and energy release rates at crack tips are further given in concise forms and numerically calculated by solving a system of linear algebra equations. It is found that for the present crack model, crack easily propagates and grows with transport current ascent, and that in the process of transport current descent, crack generally does not propagate. According to the maximum energy release rate criterion, the bigger the crack opening angle is, the easier the crack propagates. Also, either increasing the shear modulus graded index of the superconducting coating or decreasing the introduced critical state model parameters can impede crack propagation and growth. The present study should be helpful to design and application of superconducting composites.

Key words: fracture analysis; arc-shaped interfacial crack; functionally graded coating; cylindrical superconducting composite; energy release rate

1. Introduction

*Corresponding author.
E-mail address: wjfeng9999@126.com (W.J. Feng).