Proceedings of the Canadian Society for Mechanical Engineering International Congress 2022
CSME Congress 2022
June 5-8, 2022, Edmonton, AB, Canada

INVESTIGATING OF THE MIXED MODE CRACK PROBLEMS IN NONHOMOGENOUS MATERIALS UNDER UNIFORM HEAT FLOW

Guo Fengnan[1*], Zhang Yanyan[2], Guo Licheng[3], Yu Hongjun[3]
[1]School of Aeronautics and Astronautics, Dalian University of Technology, Dalian, China
[2]Department of Mechanical Engineering, University of Alberta, Edmonton, Canada
[3]Department of Astronautic Science and Mechanics, Harbin Institute of Technology, Harbin, China
*guofn@dlut.edu.cn

ABSTRACT

Thermal fracture is a main failure mode in the devices which usually used in thermal environments, such as the electrical packaging structures and the thermal barrier coating structures. How to obtain the thermal fracture parameters effectively and efficiency is a key problem for the design and application of those nonhomogeneous materials. This paper developed the interaction energy integral method (IEIM) to study the mixed mode thermal crack problems in nonhomogeneous materials. The path-independence of the modified interaction integral can be proved to be stand even when the integral domain contains complex interfaces. Due to this advantage, it is very convenient to obtain the thermal stress intensity factors (TSIFs) in materials with nonhomogeneous properties. Combined with the extended finite element method (XFEM), some examples are presented to the studied the influence of the adiabatic crack and fully conductive crack on the TSIFs. The influences of the material properties on the TSIFs are also considered. The results show that the mismatch of the elastic modulus and thermal expansion coefficient can affect the TSIFs greatly.